

# U.S. NAVAL ACADEMY MANUAL RADIOLOGICAL SAFETY PROGRAM





DEPARTMENT OF THE NAVY  
UNITED STATES NAVAL ACADEMY  
121 BLAKE ROAD  
ANNAPOLIS MARYLAND 21402-1300

USNAINST 5104.2B CH-2  
9/E&W  
9 Jan 2026

USNA INSTRUCTION 5104.2B CHANGE TRANSMITTAL 2

From: Superintendent, U.S. Naval Academy

Subj: UNITED STATES NAVAL ACADEMY RADIOLOGICAL SAFETY PROGRAM

Encl: (1) Revised Table of Contents  
(2) Revised Chapter 3  
(3) Revised Chapter 11  
(4) Addition Appendix E

1. Purpose. To transmit Chapters 3, 11, and table of contents to update the policies and procedures to better define the Radiation Safety Committee (RSC) responsibilities and emergency response requirements. Appendix E has been added to provide an example of emergency response protocols at the U.S. Naval Academy (USNA).

2. Action. Remove Chapters 3, 11, and table of contents from the basic instruction and insert enclosures (1), (2), (3), and (4).

3. Other Page Change. The revised Chapter 3 better defines how the RSC delegates authority for routine processes such as possession, usage and disposal of materials. The revised Chapter 11 now defines how USNA meets the requirements for operating and emergency procedures and removes radiological incident responses. Radiological incident responses have been moved to Appendix E to provide a clear example of emergency protocols at USNA.

3. Records Management

a. Records created as a result of this change transmittal, regardless of format or media, must be maintained and dispositioned per the records disposition schedules located on the DON Assistant for Administration, Directives and Records Management Division portal page at <https://portal.secnv.navy.mil/orgs/DUSNM/DONAA/DRM/Records-and-Information-Management/Approved%20Record%20Schedules/Forms/AllItems.aspx>.

b. For questions concerning the management of records related to this instruction or the records disposition schedules, please contact your local record custodian or USNA Record Manager.

M. J. BORGSCHULTE

Releasability and distribution:

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From: Superintendent, United States Naval Academy

Subj: UNITED STATES NAVAL ACADEMY RADIOLOGICAL SAFETY PROGRAM

Ref: (a) NAVSEA S0420-AA-RAD-010 2A with ACN-1  
(b) NAVMED P-5055  
(c) Memorandum of Understanding between United States Naval Academy (USNA)  
and Navy Medicine Readiness and Training Command Annapolis  
(d) NUREG 1556 Volume 11  
(e) 10 CFR  
(f) NAVSEA SE700-AA-MAN-100/RADIAC, Navy RADIAC Program User's  
Manual  
(g) 49 CFR  
(h) NUREG 1757 Volume 1 Revision 2

1. Purpose. To establish the policies and procedures for safely managing the radioactive material and radiation producing machine sources under the purview of the U.S. Naval Academy.

2. Cancellation. USNAINST 5104.2A.

3. Scope and Applicability. This document establishes the Radiological Safety Program (RASP) at USNA. This instruction specifies detailed policies and procedures that apply to all radioactive materials and radiation producing machine sources utilized by USNA personnel in accordance with reference (a). The USNA Radiation Health Program is managed by the Naval Health Clinic and is described in reference (b) and reference (c).

4. Policy. USNA possesses radiological materials and radiation producing machine sources used in the education of the Midshipmen and academic research activities of faculty. Since many of the radiological sources are regulated, USNA is required to establish controls for proper use and handling to ensure radiation exposure is as low as reasonably achievable. The basic mode of control of radiological materials and machines is through the issuance of a Local Authorization by the USNA Radiation Safety Committee (USNA RSC) to a USNA Licensee, which is further reviewed for regulatory compliance by the Radiation Safety Officer (RSO).

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USNA Licensees are faculty or staff who are the custodian or laboratory manager of the source.

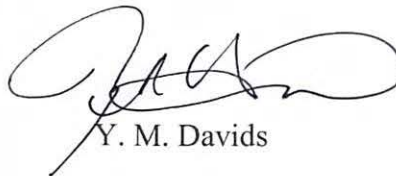
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b. For questions concerning the management of records related to this instruction or the records disposition schedules, please contact your local record custodian or the USNA Records Manager.

6. Review and Effective Date. Per OPNAVINST 5215.17A, the Radiation Safety Officer will review this instruction annually on the anniversary of the effective date to ensure applicability, currency, and consistency with Federal, DoD, SECNAV, and Navy policy and statutory authority using OPNAV 5215/40 Review of Instruction.

7. Forms. NRC Form 3 Notice to Employees can be found in the U.S. Nuclear Regulatory Commission's electronic library at <https://www.nrc.gov/reading-rm/doc-collections/forms/nrc3info.html>. The form should be utilized in accordance with chapter 4 paragraph 6.1.



Y. M. Davids

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CHAPTER 1  
REPORTING RELATIONSHIPS AND ANNUAL REQUIREMENTS

1. Responsibilities.

a. The Superintendent, as Commanding Officer of USNA, retains overall responsibility for the Radiation Safety Program (RASP) per reference (a) Section 1.5.2.

b. The Dean of the School of Engineering and Weapons (E&W Dean) is hereby delegated the RASP execution authority.

c. The Radiation Safety Officer (RSO) is appointed by the Superintendent and will report to the E&W Dean for RASP matters. The RSO will have direct access to the Superintendent for urgent RASP matters. Otherwise, routine RASP matters will be directed through the E&W Dean.

d. The Dean of the School of Mathematics & Science (M&S Dean) will report to the E&W Dean for RASP matters.

e. Assistant Radiation Safety Officers (ARSOs) report to the RSO for RASP matters.

f. Authorized users will report to the RSO for all RASP matters.

g. All personnel are encouraged to direct questions and concerns to the RSO/ARSO. In the case of an emergent/emergency event whereby the RSO/ARSO is unable to provide an effective response, USNA personnel may contact any responsible party in the reporting structure below.

h. Figure 1-1 illustrates the RASP reporting relationships.

i. The Provost, although indicated as a box in the chain of command, will only be involved as a figurative representative. The resource management will require the involvement of the Provost (e.g. budget and allocation of human resources) because USNA is considered an educational command where the faculty, staff, and military primary role is to educate the midshipmen. The Provost will not be involved in any operational or permit related duties. All Naval Radioactive Materials Permit (NRMP) changes or findings will be routed through the E&W Dean to the Superintendent's office.

2. Annual Requirements. The following are command-level requirements. This list does not include all items that labs should complete to stay compliant with radiological regulations (refer to Chapter 7).

a. Annual Program Review of the RASP is completed by the RSO per reference (a) Section 2.10.

- b. A separate Annual Program Review is completed by the Radiation Safety Committee (USNA RSC) per reference (a) Section 8.3.1.9.
- c. Annual review and update of USNA RASP Emergency and Security plan and operating and emergency procedures per reference (a) Sections 2.10.3.b and 8.5.2.13 respectively.
- d. Annual leadership briefing and training per reference (a) Sections 2.8.2.2 and Section 2.8.2.3.
- e. The RSO will review the Memorandum of Understanding (MOU) between Navy Medicine Readiness and Training Command Annapolis (NMRTCA) and USNA annually.
- f. The Superintendent and the RSO will meet semiannually to discuss the Radiation Safety Program per reference (a) Section 8.3.2.3. All aspects of the annual leadership briefing per reference (a) Section 2.8.2.3 must be covered.
- g. The (A)RSO will perform a radiation protection audit similar to Chapter 12 (Example RASP Program Audit Guide) at least every six months per reference (a) Section 2.9.1.5.

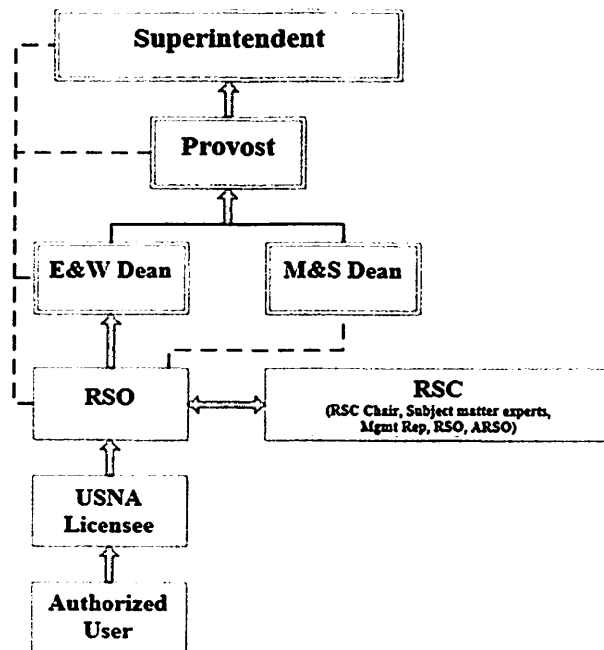


Figure 1-1 – Reporting Relationships

CHAPTER 2  
RADIATION SAFETY OFFICER (RSO)

1. RSO Appointment. The RSO is appointed by the Superintendent as the designated representative for managing the RASP per reference (a) Section 1.5.2.e.
  - a. The RSO will be responsible for the day-to-day coordination and management of the RASP.
  - b. The RSO must report to the Superintendent in a staff capacity and must brief the Superintendent on the entire RASP at least semiannually.
  - c. The RSO must have ready access to all levels of the command organization with the authority to immediately terminate a RASP project if found to be a threat to health, safety, or property and must report all radiological incidents to the Superintendent.
2. Qualifications. The RSO will be qualified as a GS-1306 Health Physicist, ideally including:
  - a. Possess an academic degree in related physical or biological sciences.
  - b. Completion of a Radiation Affairs Support Office (RASO)-approved RSO certification course.
  - c. Approximately 5 years of specific experience in radiation protection with the type, quantities, and use of radioactive material to be used under this (Broad Scope) NRMP.
  - d. Experience working in an academic and research environment.
3. RSO Responsibilities. The RSO is responsible for (as defined in reference (a) section 1.5.2.2 and 8.3.2.6):
  - a. Acting authoritatively for the Superintendent in carrying out the RSO duties and responsibilities to ensure that personnel radiation doses from RASP radiation sources are as low as reasonably achievable (ALARA).
  - b. Stopping RASP operations that he or she considers unsafe.
  - c. Responding within normal commuting time (<2 hours) if offsite when RASP operations are being performed unless an ARSO is designated to provide oversight coverage.
  - d. Establishing liaison with the supporting military treatment facility (MTF) to coordinate radiation health program requirements and any other RASP related services provided by the MTF.

e. Registering all applicable machine sources of ionizing radiation with NAVSEA DET RASO.

f. Reporting promptly to the Superintendent and NAVSEA DET RASO any incident as defined in reference (a) Section 1.5.2.1.j.

g. Maintaining NRMPs and preparing permit applications, amendments, renewals, and reports as required by federal and Navy and Marine Corps directives.

h. Establishing basic guidelines and advising supervisors and employees in radiation safety.

i. Coordinating safety evaluations of all proposed uses of radioactive material.

j. Maintaining routine surveillance and monitoring records of all controlled areas.

k. Determining compliance with rules and regulations, NRMP conditions, and the conditions of project approvals specified by the USNA RSC.

l. Maintaining procedures and overseeing receiving, opening, and delivering all shipments of radioactive material arriving at the command, and receiving, packaging, and shipping all radioactive material from the command.

m. Maintaining an inventory of all radiation sources.

n. Supervising and coordinating the radioactive waste disposal program including maintaining waste storage and disposal records and monitoring effluents.

o. Overseeing storage of all radioactive materials not in current use, including low level radioactive wastes (LLRW).

p. Distributing dosimeters and arranging for their processing, determining the need for bioassays, keeping records of personnel exposures and bioassays, notifying individuals and their supervisors of exposures that are approaching reference (a) Section 2.3.1, Table 2-1 values, and recommending and supervising appropriate remedial action.

q. Performing or arranging for calibration of instruments.

r. Performing independent surveys and inspections of radiological areas to verify conditions and work controls.

s. Performing leak tests on sealed sources and maintaining records of leak tests.

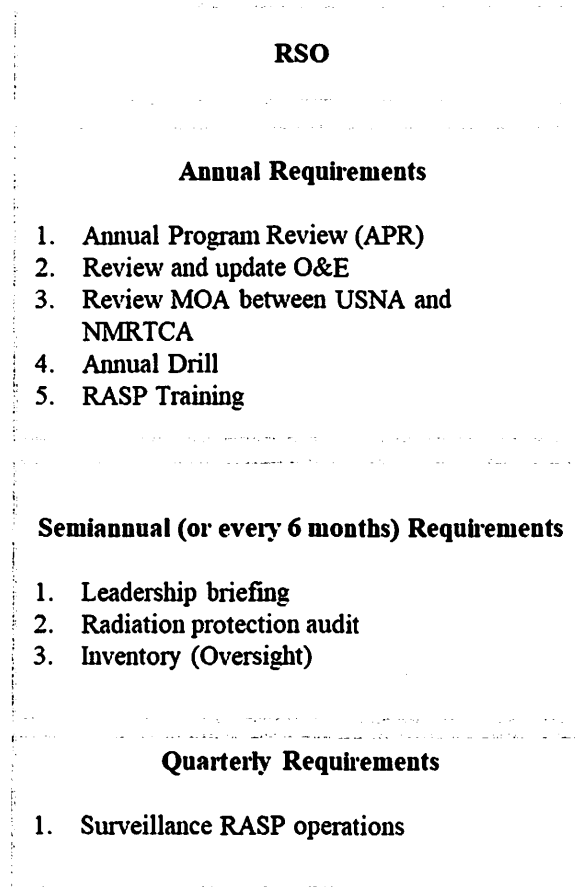
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- t. Conducting training programs and otherwise instructing personnel in the proper procedures before they are allowed to use radioactive material and as required by changes in procedures, equipment, regulations, etc.
- u. Maintaining records required by this manual, the (Broad Scope) NRMP, and those necessary to support decommissioning.
- v. Investigating all incidents involving radioactive materials including unauthorized removal and/or theft, spills and accidental releases, unauthorized receipt, medical events, and any activities which are not being conducted in full compliance with Federal, Navy, and Local regulations, and implementation of corrective actions as necessary.
- w. Implementing the recommendations of the Radiation Safety Committee (USNA RSC).
- x. Figure 2-1 provides an overview of the requirements and responsibilities of the RSO.

#### 4. Radiation Safety Office.

- a. The RSO is primarily supported by ARSOs who have completed the NAVSEA DET RASO Radiation Safety Officer training course. The ARSO will assist the RSO in performance of the RSO duties per reference (a) Section 1.5.2.3.a.
- b. Additionally, the RSO at their discretion is permitted to qualify additional personnel to assist in specific roles of the Radiation Safety Officer as needed. Those qualified will be trained in the standard as radiation workers, however dependent on job duties may not need to comply with the Radiation Health Program. The RSO shall maintain oversight of those qualified personnel. Those tasked to perform in the roles of the RSO are referred to as the Radiation Safety Office.
- c. The ARSO will perform the duties and responsibilities of the RSO in the absence of the RSO per reference (a) Section 1.5.2.3.b.
- d. The ARSO must be able to respond within normal commuting time ( < 2 hours) if offsite when RASP operations are being performed when acting for the RSO per reference (a) Section 1.5.2.3.c.

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**Figure 2-1 – RSO Responsibilities**

### CHAPTER 3 USNA RADIATION SAFETY COMMITTEE (RSC)

1. Purpose. The USNA RSC is appointed by the Superintendent to be the principal advisory group to the RSO. The USNA RSC will review and approve all proposed uses of radioactive material and other sources of ionizing radiation consistent with the “as low as reasonably achievable” (ALARA) philosophy; performs routine audits of RASP effectiveness; and reviews and acts on all incidents involving radioactive material and reported items of non-compliance with Federal, Navy, and Local command regulatory requirements. The USNA RSC may establish committees to expedite the review of license applications, enforcement issues, and policy development.

2. Membership. The Superintendent formally appoints the USNA RSC members. The RSO, with the advice of the USNA RSC Chair, will recommend a minimum of four (4) members to the Superintendent for appointment to the Committee via the Executive Management Representative, who represents the military chain of command and is charged with ensuring management support of the radioactive materials program and due consideration of the legal interests of the organization per reference (a) Section 8.3.1.2. The term of appointment will normally be for three years or projected rotation date for active-duty members. The composition of the USNA RSC must meet the membership requirements set forth in reference (a) Section 8.3.1.1-3. The membership will include, but not be limited to the following: a Chairperson, an Executive Management Representative, individuals who represent each type of use of ionizing radiation for which the command has authorization and who through training or experience possess special competence in the areas of radiation protection and/or risk assessment, the RSO, at least one ARSO, and subject matter experts from departments possessing sources/equipment capable of generating ionizing radiation. The RSO and Chair, under advisement of the Committee, will forward a membership change memorandum to the Superintendent via the designated chain of command and nominate appropriate new members should a member of the USNA RSC require replacement.

a. The Chair must have practical experience in a variety of material and machine sources of ionizing radiation and management of a RASP. Additionally, the Chair must have knowledge of radiation safety issues, good leadership abilities, the authority and credibility by virtue of their position within the facility, and a desire to serve as Chair of the USNA RSC. The RSO may not serve as Chair of the USNA RSC.

b. The Executive Management Representative will be a senior officer or equivalent senior civilian staff member who will provide support for the RASP and due consideration of the legal interests of USNA. The Executive Management Representative must have sufficient experience with radiation sources to effectively communicate between the USNA RSC and the USNA senior leadership. The Executive Management Representative will not normally be an Authorized User.

c. Other members include subject matter experts from the Schools of ECW and M&S including representatives from Chemistry, Physics, and Engineering.

3. Responsibilities. The USNA RSC responsibilities as specified in reference (a) Section 8.3.1 and reference (d) Volume 11 Chapter 8.7.2 include:

a. Review and approve, in advance of procurement, proposed uses of sources of ionizing radiation.

b. Review and approve program and procedure changes for new or modified uses of sources of ionizing radiation in accordance with criteria developed prior to implementation.

c. Advise on all RASP operations.

d. Review personnel doses and the ALARA program.

e. Review radiological incidents.

f. Perform periodic audits and surveillances per reference (a) Section 2.9. These USNA RSC audits and surveillances are in addition to the RSO audits and surveillances required by reference (a) Section 8.3.1.4.f.

g. Delegate authority to approve procurement, transfer, or disposal of radiation sources that are defined as routine.

(1) *Routine* is defined as radiological processes, including possession, usage, and disposal, that has been previously established, reviewed, and approved by the USNA RSC in designated radiological facilities.

(2) *Non-Routine* is defined as processes that have yet to be established by the USNA RSC.

h. Qualify individuals as Authorized Users.

i. Take appropriate actions when noncompliance is identified, including analysis of the cause, corrective actions, and actions to prevent recurrence.

j. Review a security plan that will be updated annually. Distribute the security plan to the Superintendent, USNA RSC members, department heads, supervisors and custodians of radioactive material and radiation sources.

k. The USNA RSC conducts a full review of the RASP program annually. This process includes reviewing compliance of Authorized Users, examining the RSO's periodic audits and

findings, discussing the results of the annual report, and the effectiveness of corrective actions in order to deter future problems and violations.

1. The Chair of the Committee is responsible for the Committee's function, including:

(1) Calling meetings of the USNA RSC at least quarterly, specifically following the major mid-year and end-of-year Radiation Safety Office audits of the complete program.

(2) Calling meetings of the USNA RSC following quarterly audits when issues within the program are detected.

(3) Calling meetings of the USNA RSC when a new or modified usage proposal is submitted (Local Authorization or licensee meeting).

(4) Calling meetings of the USNA RSC to evaluate the experience and training of new users.

m. USNA RSC meetings will normally be attended by all members of the committee either in person or virtually as needed. However, if fewer members than comprise the full committee are able to attend, a quorum will be established with the majority of members present consisting of the committee chairperson (or their designee), the RSO, the Executive management representative (or their alternate), and a representative from each area of use from which specific issues will be discussed.

n. The USNA RSC must meet at least quarterly. The USNA RSC should meet as often as needed to ensure the RASP is operating in compliance with the license, established procedures, regulations as well as to act on unresolved or new safety issues, non-routine requests, or uses that require extra command or departmental coordination or cooperation.

o. Minutes of the quarterly meetings of the USNA RSC are prepared by the USNA RSC Chair to document the proceedings and safety evaluations of principal users (referred as USNA Licensees) of radioactive material. The minutes should include the date of meeting, the members present and absent to demonstrate a quorum was present, a summary of discussions, recommendations, the results of votes, and review of new users, uses, and programs changes. The minutes should also include information related to the ALARA program reviews and the annual audit review. The RSO maintains records of the USNA RSC meetings, which are available to the USNA Superintendent.

p. The criterion for approving research authorizations and users will include adequacy of the facility and equipment, personnel monitoring and survey equipment, required surveys, operating, handling, and emergency procedures; and the experience and training of proposed users of greater than exempt quantities of radioactive material. Information that will be provided by prospective Laboratory Managers (also referred internally as USNA Licensee) for each

evaluation includes a USNA Radioactive Materials Local Authorization or USNA Machine Source Local Authorization and a proposed Safety Standard Operating Procedure (SOP) where applicable. Information that will be provided by the RSO/ARSO for each evaluation include a pre-use inspection for adequacy of proposed facilities and equipment, assurance that appropriate personnel monitoring and survey equipment is available and regulatory guidance provided by Federal, U.S. Navy, and national consensus standards.

q. Radioactive materials and machine sources are to be used by or under the direct supervision of individuals designated by the USNA RSC. The USNA RSC Chair reviews and approves all procedures implemented by the RSO and Laboratory Managers for controlling/maintaining inventories, procurement, individual possession limits, total possession limit, and transfer of radioactive material within/outside of USNA.

r. Figure 3-1 summarizes the responsibilities of the USNA RSC.

#### 4. Conduct of Business.

a. The USNA RSC may establish working groups or subcommittees, as needed, to prepare documents or preliminary evaluations for consideration by the whole USNA RSC. The USNA RSC leadership may create temporary subgroups to deal with specific issues, such as licensing or special authorizations or education and training.

b. The USNA RSC will review and approve or disapprove all proposed uses of radioactive material on the USNA campus; develop, approve and audit programs required to ensure the radiological health and welfare of DoD personnel and the general public, and compliance with pertinent Federal, Navy, and Local regulatory requirements. In fulfilling these responsibilities, the Committee will:

(1) Review on the basis of safety, and with regard to Navy and Federal standards for training and experience, all applications for a license for radioactive material.

(2) Evaluate the adequacy of facilities and equipment for specific radionuclide applications.

(3) Review annually, with the assistance of the RSO, a summary of the occupational radiation dose records of all personnel, giving attention to individuals or groups of workers whose occupational exposure appears excessive.

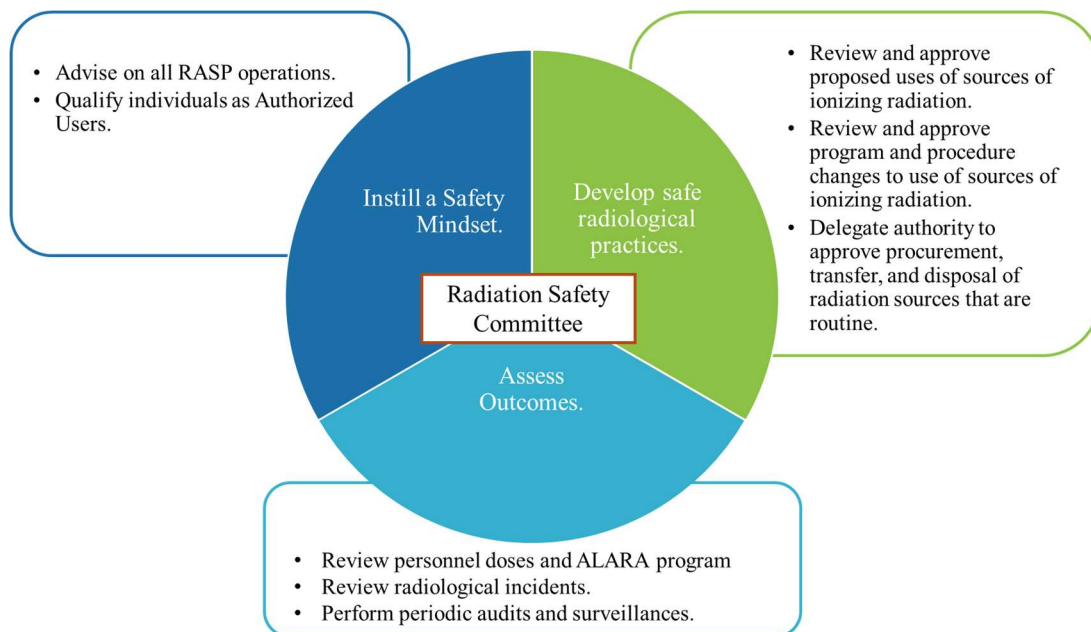
(4) Review all persons whose duties may require access to posted radiation areas to perform specific functions and receive ionizing radiation exposure incidental to performing normal work tasks or the Authorized Users of scanning electron microscope (SEM), X-ray diffraction (XRD), or (X-ray fluorescence) XRF machines. All personnel including midshipmen,

faculty/staff, fire/security, and housekeeping should be appropriately instructed as required in reference (a) Section 2.8.

(5) Review at least annually the Radiation Safety Office's summary report of the entire RASP to determine that all activities are being conducted safely, in accordance with the U.S. Nuclear Regulatory Commission (US NRC) and NAVSEA DET RASO regulations and the conditions of the Local Authorization/licenses, and consistent with the ALARA program and philosophy. The review must include an examination of records, reports from the RSO, results of NAVSEA DET RASO inspections, written safety procedures, and the adequacy of the management control system.

(6) Recommend remedial action to correct any deficiencies identified in the RASP; working with radioactive material; and all incidents involving radioactive material with respect to the cause and the corrective actions taken.

c. The USNA RSC may combine multiple committee meeting agendas under one unified meeting umbrella.



**Figure 3-1 – USNA RSC Responsibilities**

CHAPTER 4  
RADIATION HEALTH AND EXPOSURE LIMITS

1. Memorandum of Understanding Between Superintendent, United States Naval Academy (USNA) and Commanding Officer, Navy Medicine Readiness and Training Command Annapolis (NMRTCA). USNA and NMRTCA has a written memorandum of understanding (MOU) outlining the responsibilities of each party within the Radiation Health Program (reference (c)). NMRTCA is responsible for the methods and procedures necessary to protect the health of all personnel exposed to ionizing radiation or radioactive material. USNA responsibilities are focused on compliance of these practices, including participation in medical exams and dosimetry, as applicable. The MOU is reviewed every year and renewed every 5 years.

2. Exposure Limit Requirements.

a. The local policies set forth in this section have been established to restrict the use of radioactive material in such a manner as to maintain the radiation exposure to USNA personnel and the general public ALARA, to minimize the danger to property and the environment, and to ensure compliance with all applicable Navy and Federal regulatory codes.

b. Each user of ionizing radiation, whether a licensee or an individual working under the authority of a licensee, must ensure that they do not possess or handle radioactive materials unless all applicable provisions of this chapter are met.

c. A Restricted Area is defined to be synonymous with a Radiation Area in reference (a) Section 2.17.3 and must be posted as a Radiation Area per reference (a) Section 2.17.4. A Restricted/Radiation Area is defined as any location in which there is a likelihood of an individual: Receiving a 2 millirem/hr (0.02 mSv/hr) (external) whole body deep dose of continuous exposure at 30 centimeters from the radiation source or from any surface that the radiation penetrates.

d. An unrestricted area is any location in which there is no reasonable likelihood of an individual being exposed to the limits identified in Chapter 4 Section 2.c above.

e. Each licensee will take appropriate steps to limit the access to the restricted area under their supervision so that only authorized individuals, using a personal radiation monitoring device (when required), may enter.

f. Areas used for shipping, receiving, or transporting radioactive material packaged in accordance with Navy and Federal Department of Transportation (DOT) regulations are exempt from the requirements for a restricted area. These areas must not be used for long term storage of radioactive material.

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### 3. Permissible Limits of Radiation Exposure.

a. Radioactive material and/or other sources of radiation will not be used in such a manner as to cause an adult to receive in excess of the more restrictive of the radiation doses. Table 4-1 outlines the permissible dose limits as established by reference (a) Section 2.3.1, reference (b) Section 4-3, and reference (e) Part 20.

**TABLE 4-1 – Occupational Dose Limits**

| <b>Description of the Dose Type</b>                                                                                                 | <b>RASP Limit</b>                 | <b>Local ACL</b>              |
|-------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|-------------------------------|
| Total Effective Dose Equivalent<br>(Whole Body)                                                                                     | 3.0 rem/qtr<br>(0.03 Sv/qtr)      | 0.125 rem/qtr<br>(0.00125 Sv) |
| Total Effective Dose Equivalent<br>(Whole Body)                                                                                     | 5.0 rem/year<br>(0.05 Sv/yr)      | 0.5 rem/yr<br>(0.005 Sv/yr)   |
| Shallow Dose Equivalent<br>(Extremities)                                                                                            | 50.0 rem/year<br>(0.5 Sv/yr)      | 5.0 rem/yr<br>(0.05 Sv/yr)    |
| Shallow Dose Equivalent<br>(Skin)                                                                                                   | 50.0 rem/year<br>(0.5 Sv/yr)      | 5.0 rem/yr<br>0.05 Sv/yr)     |
| Eye Dose Equivalent<br>(Eyes)                                                                                                       | 15.0 rem/year<br>(0.15 Sv/yr)     | 1.5 rem/yr<br>(0.015 Sv/yr)   |
| Sum of Deep Dose Equivalent and Committed Dose<br>Equivalent for any organ or tissue other than the lens of the<br>eye (Organ Dose) | 50.0 rem/year<br>(0.5 Sv/yr)      | 5.0 rem/yr<br>(0.05 Sv/yr)    |
| Non-Radiation Workers (Whole Body)                                                                                                  | 0.5 rem/yr<br>(0.005 Sv/yr)       | 0.1 rem/yr<br>(0.001 Sv/yr)   |
| Embryo/Fetus (Declared Pregnant Worker)                                                                                             | 0.5 rem total<br>(0.005 Sv total) | 0.05 rem/mo<br>(0.005 Sv/mo)  |
| Members of public                                                                                                                   | 0.1 rem/yr<br>(0.001 Sv/yr)       | N/A                           |
| Minors                                                                                                                              | 0.5 rem/yr<br>(0.005 Sv/yr)       | 0.1 rem/yr<br>(0.001 Sv/yr)   |
| Rem = Roentgen Equivalent Man<br>Sv = Sievert<br>Qtr = quarter<br>Yr = year                                                         |                                   |                               |

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|            |
|------------|
| Mo = month |
|------------|

(1) General Public. Radioactive material must be stored and handled in a manner so that no member of the general public receives a dose rate exceeding 2 mrem/hr (0.02 mSv/hr) or total effective dose equivalent (radiation dose) in excess of 0.1 rem (1 mSv) per year resulting from the sum of the (external) whole body dose equivalent and the (internal) committed effective dose equivalent.

(2) Radiation Workers. Radioactive materials must be stored and handled in a manner so that no individual occupationally exposed receives a radiation dose in excess of the rem limits in Table 4-1, where rem is defined as the absorbed dose in rads multiplied by a quality factor (The quality factor for beta particles of energies below 0.05 keV is 1.7, the quality factor for all other beta particles, gamma rays, and X-rays is 1.0).

b. USNA will comply with any administrative control limits (ACL) as described by reference (a) Section 2.3.1. USNA ACL values are listed in table 4-1. Any increases to an ACL must be approved in writing by the Superintendent.

c. The annual dose limit must be the more limiting of:

(1) For radiation workers whose prior or current year exposure is unknown, the annual limits will be reduced by one-quarter for each quarter of the current year for which records of exposure are unavailable or incomplete. For example, if new employees are hired in June and state that they were exposed at their previous job earlier in the year but records are unavailable, then the annual exposure limits for the new employees must be reduced by one-quarter for the first and second quarters of the year.

(2) Non-radiation Workers. Radioactive material and/or other sources of ionizing radiation exposure must not be used in such a manner as to cause any non-radiation worker to exceed the values in Table 4-1. It must be locally documented that due to limited source usage, occupancy or transient situations the individual's total effective dose equivalent is not expected to exceed values in Table 4-1.

(3) Embryo/Fetus. If a pregnant worker who is monitored for occupational exposure voluntarily notifies her command in writing of her pregnancy and the estimated date of conception, exposure to the embryo/fetus must not exceed values in Table 4-1. These limits only apply if the worker decides to declare pregnancy.

(a) The dose to the embryo/fetus must be taken as the sum of the deep dose equivalent to the declared pregnant woman and the dose to the embryo/fetus from radionuclides in the embryo/fetus and declared pregnant woman.

(b) If the dose to the embryo/fetus is found to have exceeded 500 mrem (5 mSv) or is within 50 mrem (0.5 mSv) of this dose by the time the woman declares the pregnancy, the

activity will be deemed to follow the limit if the additional dose to embryo/fetus does not exceed 50 mrem (0.5 mSv) during the remainder of the pregnancy.

(4) Minors. No individual under 18 years of age must receive an occupational exposure to ionizing radiation in excess of 10 percent of the annual total effective dose equivalent limit for radiation workers.

d. In an emergency, it may be necessary for emergency workers to exceed occupational dose limits in Table 4-1 to save life or valuable property. In such situations, the probable risk of high exposure to the rescuer must be weighed against the expected benefits. In emergency situations:

(1) That requires personnel to search for and remove injured personnel or that require entry to prevent conditions that would probably injure numbers of people, reasoned judgment is permitted; no upper dose limit is specified. In all cases, exposures should be kept as low as practicable by using rotation of workers and other standard methods to minimize exposure.

(2) Workers used in such activities should be limited to non-pregnant volunteers who are aware of the risks associated with the projected dose.

(3) Where it is desirable to enter a hazardous area to protect facilities, eliminate further escape of contamination, or to control fires, the planned total effective dose equivalent should not exceed 10 rem (0.1 Sv). Workers used in such activities should be limited to non-pregnant volunteers. This limit may be increased with only written NAVSEA DET RASO or NRC approval.

#### 4. Additional Exposure Limit Restrictions.

a. The quarterly whole body external deep dose component of the annual effective dose equivalent limit listed in Table 4-1 above, must not exceed 0.125 rem (0.00125 Sv).

b. If an individual receives an exposure which exceeds the 0.125 rem (0.00125 Sv) quarterly limit, but does not exceed the 0.500 rem (0.005 Sv) annual administrative limit, then the licensee must limit further exposure to the individual such that the 0.500 rem (0.005 Sv) annual administrative limit is not exceeded.

c. If an individual receives a dose that exceeds the annual 0.500 rem (0.005 Sv) administrative dose limit, the licensee must not assign that person to any task in which there is a likelihood of any additional occupational exposure.

d. The USNA RSC will not approve tasks or procedures which may be expected to result in any of the following situations:

- (1) Ingestion of radioactive material in excess of 10% of the Allowable Limit of Intake (ALI).
- (2) Exposure to airborne concentrations of radioactive material in excess of 10% of the Derived Air Concentration (DAC).
- (3) Exposure to concentrations of radioactive material in excess of 10% of the Maximum Permissible Average Concentrations (MPAC) in Air and Water.
- (4) Minors and declared pregnant women likely to receive, in one (1) year, a committed effective dose equivalent in excess of 0.500 rem (0.005 Sv; or 0.050 rem/month).
- (5) The following restrictions must apply to the radiation exposure to declared pregnant employees.
  - (a) If the pregnant employee has notified her supervisor of the pregnancy, the supervisor will in turn notify the RSO. She may notify the RSO directly.
  - (b) The licensee must make efforts to avoid substantial variation above a uniform monthly exposure rate to declared pregnant women so as to satisfy the 0.5 rem (5 mSv) limit.
  - (c) The RSO will determine whether there is a likelihood of the embryo/ fetus receiving the 0.500 rem (5 mSv) limit. If this possibility exists, then the individual will be assigned tasks which require significantly less or no radiation exposure. At her request, the employee may continue to be assigned the same tasks; however, the frequency of thermoluminescent dosimeters (TLD) exchanges will be increased to twice a month. If the TLD readings indicate that the 0.500 rem limit may be exceeded, the employee must be removed from her presently assigned tasks and assigned responsibilities which involve significantly less or no radiation exposure.
  - (d) The dose to the embryo/fetus must be taken as the sum of the deep dose equivalent to the declared pregnant woman and the dose to the embryo/fetus from radionuclides in the embryo/fetus and radionuclides in the declared pregnant woman.
  - (e) Radioactive material must be stored and handled in a manner such that no minor or declared pregnant woman will be exposed to a radiation dose in excess of 10% of the RASP limits specified in Table 4-1 and reference (a) Section 2.3.5.

## 5. Personal Monitoring Requirements.

- a. Personal and area monitoring dosimetry devices will be distributed, and maintained by NMRTCA. NMRTCA is responsible for distribution, collection, sending used dosimetry to the

local processing facility, and receiving and distributing reports to the RSO. The Radiation Safety Office will assist the Radiation Health Technician in performance of duties.

b. TLD monitoring of whole-body radiation doses will be issued by the RSO with assistance from the Radiation Health Technician to individuals with the potential of receiving radiation exposure in excess of general public exposure limits. The RSO will distribute dosimetry results to appropriate individuals each quarter.

c. Individuals assigned to handle sources of penetrating radiation must be issued finger (ring) monitors to determine the absorbed dose to the hands when working with more than 1 mCi of an unshielded source of high energy beta (e.g. P-32) or photon emitter (e.g. I-125) per reference (c).

d. The Radiation Safety Office will provide auxiliary monitoring devices, including direct reading dosimeters, to any individual where the absorbed dose to a body part may not be adequately defined by the readings obtained with a TLD or finger monitor.

e. Other individuals who are exposed to radiation on an occasional basis such as security, personnel who deliver packages, secretarial staff, short term visitors, or those who perform routine maintenance or service will not normally be issued personal monitoring devices.

f. TLDs and finger monitors will be exchanged on a 13-week basis.

g. Each individual who is issued a personal monitor must ensure that:

(1) A personal monitoring device intended to measure whole body exposure is worn on the front of the trunk of the body, e.g. on the collar, chest pocket, or belt when the source of the radiation is likely to be isotropic or from the front of the wearer. For neutron monitoring, the DT-702/PD-TLD must be worn on the waist per reference (b) Section 6-5.7.

(2) A finger monitor is worn on the tip of the finger (under the protective glove) on the hand most frequently used to handle radioactive material.

(3) They only wear the personal monitoring device(s) assigned to them by the Radiation Health Technician.

(4) They immediately notify the RSO when a personal monitoring device is lost, or if it is suspected that a monitor has become contaminated or damaged.

(5) They protect the personal monitoring devices against exposure to high heat or humidity, and do not remove the devices from the USNA.

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(6) Personal monitoring devices are issued to determine an individual's occupational exposure only. Monitoring devices will not be worn by an employee receiving a medical examination or treatment involving ionizing radiation.

(7) It is the responsibility of each licensee to ensure that individuals under his/her supervision are provided with personal monitoring devices according to the requirements for operation of their facility.

h. When applicable, a secondary dosimeter will be distributed where immediate indication of exposure is desirable per reference (b) Section 6-6.1. A Navy-approved Mk2 Electronic Personal Dosimeter (EPD) will be used as a secondary dosimetry.

(1) Secondary dosimeters will be worn when working in high and very high radiation areas, and when determined necessary by the responsible RSO per reference (a) Section 2.6.3.2.

(2) Secondary dosimeters must be used with each primary dosimeter and worn adjacent to the primary dosimeter per reference (a) Section 2.6.3.4.

(3) Secondary dosimeters will be read at the following times (reference (a) Section 2.6.3.6):

(a) When initially issued.

(b) Just prior to commencing operations.

(c) Between each exposure or evolution during operations.

(d) Periodically, when in a radiation area or high radiation area.

(e) At the end of operations.

(4) EPD dose and dose rate alarm set points will be set by a RADIAC calibration laboratory at 200 mrem (2 mSv) and 200 mrem/hr (2 mSv/hr), respectively (reference (a) Section 2.6.3.10).

(5) Use of secondary dosimeters must be documented and records maintained per reference (a) Section 2.26.2.

## **6. Exposure: Notice Requirements and Postings.**

a. All signs and labels used to caution individuals of the presence of radiation or radioactive materials must have a standard three-bladed radiation symbol in black or purple on a yellow background.

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b. Each room where licensed radioactive materials are used or stored must be posted with a conspicuous sign bearing a radiation symbol and the words "Caution, Radioactive Materials." (reference (a) Section 2.16.1.5 and reference (e) Part 20 Appendix C)

c. Each room in which there is a location where an individual may receive a whole-body dose equivalent of 2 millirem (0.02 mSv) per hour at a distance of 30 centimeters from a source or a surface through which the radiation penetrates must be posted with a conspicuous sign bearing a radiation symbol and the words "Caution, Radiation Area".

d. Each room in which there is a location where an individual may receive a whole-body dose equivalent of in excess of 100 millirem (1 mSv) per hour at a distance of 30 centimeters from a source or a surface through which radiation penetrates must be posted with a conspicuous sign bearing a radiation symbol and the words "Caution, High Radiation Area" or "Danger, High Radiation Area."

e. Each room in which there is a location where an individual may receive an absorbed dose in excess of 500 rads (5 grays) in one hour at a distance of 100 centimeters from a radiation source or from any surface through which radiation penetrates must be posted with a conspicuous sign bearing a radiation symbol and the words "Grave Danger, Very High Radiation Area."

f. Each room in which radioactive material could potentially be dispersed in the air in the form of dusts, fumes, particulates, mists, vapors, or gases, must be posted with a conspicuous sign bearing a radiation symbol and the words "Caution, Airborne Radioactive Material".

g. Each room in which airborne radioactivity exists in concentrations listed below must be posted with a conspicuous sign bearing a radiation symbol and the words "Caution, Airborne Radioactivity Area" or "Danger, Airborne Radioactivity Area."

(1) In excess of 10% of the derived air concentrations (DACs) specified in reference (e) Part 20 Appendix B.

(2) To such a degree that an individual present in area without respiratory protective equipment could exceed, during the hours an individual is present in a week, an intake of 0.6% of the ALI or 12 DAC hours.

h. Each refrigerator, freezer, cabinet or other device or appliance which contains radioactive material must have a conspicuous sign bearing a radiation symbol and the words "Caution, Radioactive Materials."

i. Each container of radioactive material must have a durable label bearing a radiation symbol and the words "Caution, Radioactive Material" or "Danger, Radioactive Material." In addition, the label will also specify the radionuclide present, the date, and the activity present on that date.

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j. Each container used for temporary storage of radioactive waste must be conspicuously posted with a label bearing a radiation symbol.

k. Each sink used for decontamination must be posted with a sign bearing a radiation symbol and the words "Caution, Radioactive Material."

l. In addition to posting signs and labels to caution individuals of the presence of radiation and/or radioactive materials, reference (e) Part 19 requires all activities and persons who receive, possess, use or transfer radioactive materials covered under the USNA NRMP to prominently post certain documents. The documents, notices, and forms must appear in a sufficient number of places to permit individuals who receive, store or transfer radioactive material covered under the USNA NRMP to observe them on the way to or from any particular location.

(1) Copies of form NRC 3 Notice to Employees.

(2) A copy of any notice of violation involving radiological working conditions, proposed imposition of civil penalty, any order by the NRC, and any response to the violation.

(3) The following will either be posted in the same location, or if posting of a document specified below is not practicable, the command may post a notice that describes the document, including the name of the individual to whom reports may be made, and states where they may be examined:

(a) Reference (e) Parts 19, 20, 21 and 40.

(b) A current copy of the USNA NRMP.

(c) A copy of this instruction which contains the operating and emergency procedures applicable to the permitted activities.

(d) Section 206 of the 1974 Energy Reorganization Act.

(e) NRC Regulatory Guides 8.13 and 8.29.

(4) A list of individuals, with telephone numbers, who should be contacted in the event of a radiation incident.

(5) The emergency procedures as described in Chapter 11 must be accessible within the room. This document does not need to be posted. However, the document should be an accessible hardcopy found alongside the standard operating procedures.

(6) "No eating and drinking" signs

m. Each licensee will, prior to removal or disposal of empty uncontaminated containers to unrestricted areas, remove or deface the radioactive material label or otherwise clearly indicate that the container no longer contains radioactive material.

n. Posted signs should be consistent with current radiation, contamination, and airborne levels. Signs should be removed, covered or deactivated when the risk is no longer present.

CHAPTER 5  
APPLICATIONS FOR LOCAL USNA LICENSES TO USE  
RADIOACTIVE MATERIAL OR MACHINE SOURCES

1. General Information.

a. USNA has been issued a Type A Broad Scope Naval Radioactive Materials Permit (NRMP) from the U.S. Naval Radiation Safety Committee (NRSC) for reactor-produced, accelerator-produced, and naturally occurring radionuclides (byproduct material). Ionizing producing machine sources are registered with NAVSEA DET RASO and are regulated under the guidelines of reference (a). Under the provisions of the NRMP, the issuing agencies do not accept applications from researchers for individual licenses, but instead require that the individuals apply for authorization from the USNA RSC to work under the institution's broad scope NRMP. Thus, the **USNA RSC acts as local responsible authority**, answerable to NAVSEA DET RASO, the NRSC, and the US NRC.

b. In acting on a license application, the USNA RSC will require the same training, experience, and facilities requirements as is employed by the NRC and NAVSEA DET RASO (reference (d)).

c. An applicant is an individual who is applying for a USNA License with the USNA RSC for use of radioactive materials and/or ionizing radiation producing machine sources.

d. A licensee is an individual who has been approved for a USNA License by the USNA RSC for use of radioactive materials and/or ionizing radiation producing machine sources.

2. Application Requirements for a USNA Local Authorization or License. The following criteria must be met when preparing an application for a USNA Local Authorization for use of radioactive materials and/or ionizing radiation producing machine sources (reference (a) Section 8.4.2 and reference (d) appendix B).

a. The applicant's information (Name, Title, Department, Building and Office Number, email address, and phone number).

b. The locations where the radioactive material or machine source will be used or stored.

c. The element and mass number, chemical and/or physical form(s), possession limit(s), and proposed use(s), contained in the application are authorized under the NRMP, if applicable.

d. The manufacturer, model, and serial number of the machine source including the maximum voltage and amperage when operated, if applicable.

e. The applicant (and designated authorized user(s)) possess(es) adequate training (provided by the USNA Radiation Safety Office) and experience to use the requested radionuclide(s) or machine sources in such a manner as to protect health and minimize the danger to DoD personal and property.

f. The applicant has attended the required portions of the radiation safety training program presented by the Radiation Safety Office.

g. The applicant has described all proposed uses for radioactive materials or machine sources requested. The following criteria list the authorized uses for radioactive material and machine sources.

(1) Radioactive materials and machine sources obtained under a local USNA license will only be used for research and development and teaching purposes.

(2) The applicant will limit the use of radioactive materials and machine sources to only those purposes authorized in their license and in such a manner as to maintain compliance with the conditions specified in the license.

(3) Radioactive material and machine sources must not be used in or on humans and will not be used for in vitro tests for the purpose of obtaining diagnostic medical information for use in the treatment of human subjects.

h. The applicant's laboratory facilities have been deemed adequate by the USNA Radiation Safety Office for the radioactive material(s) or machine sources requested, and the applicant possesses sufficient safety devices and monitoring equipment to protect health and minimize the danger to DoD personnel.

i. The applicant has described general safety principles, operating and emergency procedures for radioactive materials or machine sources requested, and implementation of ALARA principles.

3. Authorized User Designation. Radioactive material and machine sources must only be used by the licensee and those individuals under their supervision who are designated authorized users. In order to qualify as an authorized user, the individual must meet the following conditions.

a. The individual must have received on job training from the licensee covering the specific procedures and attendant hazards associated with the work to be performed.

b. The individual must complete the associated RASP related training for that machine or source (refer to CH 6).

c. The individual will be approved and acknowledged by School Leadership and Departmental Leadership (USNA equivalent of Branch and Division Managers).

d. The individual will be approved, qualified, and designated by the USNA RSC.

e. The RSO will review all authorized user's qualification cards.

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4. Facilities Classifications for Radiological Laboratories. Radiological laboratories at USNA must be classified as follows:

a. Radioactive Material Storage and Use Areas. Each use and storage area, with quantities of radioactive material greater than 10 times the quantities listed in reference (e) Part 20 Appendix C.

b. Restricted Area. A RASP restricted area is defined as an area that meets the requirements of a radiation area.

c. Radiation Area. A radiation area is defined in reference (e) Part 20.202 (b) (2) as any area, accessible to personnel, in which radiation, originating in whole or in part within licensed material, exists at such levels that a major portion of the body could receive a dose greater than 5 millirem in 1 hour or greater than 100 millirem in 5 consecutive days.

d. High Radiation Area. A High Radiation Area is any area with dose rates greater than 100 millirems (1 millisievert) in one hour 30 centimeters from the source or from any surface through which the ionizing radiation penetrates.

e. Very High Radiation Area. A Very High Radiation area is defined as an area, accessible to individuals, in which radiation levels from radiation sources external to the body could result in an individual receiving an absorbed dose in excess of 500 rads (5 grays) in 1 hour at 1 meter from a radiation source or 1 meter from any surface that the radiation penetrates. Very high radiation areas must be equipped with additional measures to ensure that an individual is not able to gain unauthorized or inadvertent access.

f. Radiation Contamination Area. A Contamination Area is defined as an area with the presence of a radioactive substance on a surface in quantities in excess of  $0.4 \text{ Bq/cm}^2$  ( $1 \times 10^{-5} \text{ } \mu\text{Ci/cm}^2$ ) for beta and gamma emitters and low toxicity alpha emitters, or  $0.04 \text{ Bq/cm}^2$  ( $1 \times 10^{-6} \text{ } \mu\text{Ci/cm}^2$ ) for all other alpha emitters.

g. Airborne Radioactivity Area. Airborne radioactivity areas are defined as areas where airborne radioactivity concentrations exceed 10 percent of the derived air concentration values of reference (e) Part 20 Appendix B.

h. For areas of High Radiation or Very High Radiation, the entrance or access point to the area must have one of more of the following features:

(1) Equipped with a control device (i.e., interlock) that, upon entry into the area, causes the level of radiation to be reduced below 100 mrem/hr (1 mSv/hr) at 30 centimeters from the radiation source or from any surface that the radiation penetrates (reference (e) Part 20.1601(a)(1)).

(2) Equipped with a control device that energizes a conspicuously visible or audible alarm signal automatically so that the individual entering the high radiation area and the operator

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or supervisor of the operation generating the high radiation area are made aware of the entry (reference (e) Part 20.1601(a)(2)).

(3) Locked, except during periods when access to the areas is required, with positive control over each individual entry (reference (e) Part 20.1601(a)(3)).

(4) The controls required above must be established in a manner such that no individual is prevented from leaving the affected high radiation area or very high radiation area.

#### 5. Facilities Requirements for Radiological Laboratories.

a. Radioactive material must only be used and stored in those areas designated in the applicants (or licensee's) approved radioactive material application. Radioactive material used in an unrestricted area must be under the constant surveillance and immediate control of the RSO, ARSO or an authorized individual. Radioactive material will not be stored in office spaces, food storage areas, or berthing areas.

b. The USNA RSC will not approve a radioactive material license application until the RSO has inspected the applicant's laboratory facilities and determined that the below minimum requirements are met.

(1) All work surfaces will be constructed of smooth, non-porous material (such as stainless steel or non-porous stone), which is resistant to absorption of, or reactions with, radioactive compounds.

(2) Sinks used for decontamination or disposal of radioactive material will be lined with a smooth, non-porous material and have drain traps made of glass or other non-porous, non-corrodible material and must be marked with the radiation symbol and additional precautionary information.

(3) If unsealed material is intended to be used, a fume hood will be present which is located away from windows, doors, and ventilation outlets. All airflow lines will be directed into the hood with a minimum velocity of 100 linear feet per minute at the face with the sash fully open. The walls of the hood will be smooth and non-porous, and resistant to absorption of, or reaction with, radioactive materials. The floor of the hood will be sufficiently strong to support lead shielding when required.

(4) There will be means of securing access to the room whenever no authorized users are present. Radioactive material storage and use area access will be limited to individuals authorized by the command.

(5) Refrigerators, freezers, and cabinets used for storage of radioactive material must be lockable to prevent unauthorized access.

(6) The radiation exposure rate in unrestricted areas adjacent to the laboratory facility must be less than 0.5 mrem per hour with the proposed radionuclide(s) and activity(s) fully unshielded at the proposed work locations within the lab.

(7) Appropriate shielding to use radioactive materials (Lucite/plexi-glass for beta emitters, lead for gamma emitters) must be available.

(8) The laboratory will be equipped with remote handling devices such as pipettes, tongs, etc.

(9) If storing radioactive material in a locked box, safe, cabinet, fridge/freezer, a visible lock must be present. The containment must either be physically secured or be of sufficient weight to prevent unauthorized movement of the containment vessel.

c. In addition to the laboratory specifications identified in Chapter 5 Section 2.h above, the USNA RSC may impose other requirements, before or after a licensee's application is approved, to ensure that health and environmental safety are maintained.

d. The USNA RSC will not approve an application for a radioactive material license until the RSO determines that the applicant, as a minimum, possesses the appropriate safety resources and equipment to satisfy the below requirements.

(1) Each applicant will maintain appropriate personal protective equipment (PPE) as dictated by level of radiological hazard.

(2) Each applicant will possess remote pipettes for transferring radioactive solutions.

(3) Each applicant will maintain a supply of waterproof backed absorbent paper to protect large surfaces against contamination, and splash trays of adequate size to protect against spills when large volumes of radioactive solutions are handled.

(4) Each applicant authorized to use sources of penetrating photon or high energy beta radiation will possess remote handling devices of appropriate design and of such diversity as to preclude the necessity of handling unshielded sources with the hands.

(5) Each applicant authorized to use phosphorus-32, or other sources of high energy beta radiation must possess a Plexiglas (or Lucite, etc.) shield with a minimum thickness of 0.5 inches or 1.25 centimeters, and of a size sufficient to protect the body and head of the worker.

(6) Each applicant authorized to use sources of penetrating photon radiation must possess lead shields of appropriate design and of such diversity to individually shield each source greater than 10 microcuries, or must possess lead blocks and/or sheets to construct a "cave" or similar concept to shield sources. Licensees who routinely use millicurie amounts of photon emitters must possess an "L-block" shield with a lead glass view window to protect the body and head of the worker.

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(7) Each applicant authorized to use millicurie quantities of penetrating radiation will possess a GM survey meter (USNA provided RADIAC) having probe with a window sufficiently thin to allow detection of the radiation emitted by the source(s).

(8) Each applicant will have access to a Navy NAVSEA DET RASO approved detector (referred to Chapter 8: Survey instrument types and calibration) for analysis and surveys for gamma emitting radionuclides.

(9) Each applicant authorized to use a volatile form of radioactive material must possess breathing masks having a filter designed to protect against inhalation of the radioactive compound. Volatile compounds should be used in a fume hood.

(10) Each applicant that could generate waste must possess appropriate containers for temporary storage of radioactive waste.

e. The USNA RSC may at any time require an applicant obtain any further resources and equipment which it deems necessary to ensure the protection of health or the environment.

6. Facilities Design and Modifications. It is the responsibility of the Radiation Safety Office and School Leadership to review and approve facilities design or modifications. Reference (a) Section 2.24 outlines the requirements for areas where radioactive material or ionizing radiation producing machines will be used.

a. Commands planning to build or modify radiological facilities will submit design plans to NAVSEA DET RASO at 35% and 100% design completion for review and approval.

b. Design plans should include (summarized from reference (a) Section 2.24.5):

(1) All sources of radiation to be housed in the facility

(2) Types and thickness of construction materials

(3) Presence of nearby radiation sources which may contribute to radiation levels within the facility

(4) Location and function of facility safety systems such as interlocks, warning lights and alarms, and access controls to radiation and high radiation areas.

(5) Detailed drawings of penetrations through walls, ceiling, floor, or doors of shielded rooms.

(6) Applicable shielding calculations and assumptions for all shielded spaces in the facility.

7. Application Procedures and Review for a USNA Local Authorization or License.

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- a. A completed non-human use application must be submitted for acquisition of a new license, renewal of a license about to expire, or for an amendment of existing license, where significant changes in the authorized activities are requested. When an amendment request involves only minor changes in the licensed activity, application may be made in the form of a memorandum detailing the requested changes.
- b. A template for non-human use local authorization/license is available from the Radiation Safety Office and must be submitted electronically. During review of the application, the USNA RSC may require further information before determining whether to issue a license. In this case, all additional information provided by the applicant will be incorporated as part of the original application.
- c. Applications submitted to USNA Radiation Safety Office will receive an initial review for clarity and completeness and are then presented to USNA RSC for review during its next meeting or by special tasking. Following approval by the USNA RSC, the applicant may begin licensed activities.
- d. All applications must include draft standard operating procedures (SOPs) for individual sources of ionizing radiation (radioactive material or machine sources). All draft standard operating procedures must be provided to the USNA RSC for review and approval by the USNA RSC prior to being approved by the applicable Dean.
- e. Following its review of a non-human use application the USNA RSC will recommend approval provided the criteria in CH 5 Section 2 are met.
- f. No use of radioactive materials or machine sources is permitted until its use and/or uses are approved by the USNA RSC. Only routine use and/or uses are approved on an interim basis by the RSO. The USNA RSC has established the following criteria for "routine" uses that can be given interim approval: Sealed exempt sources - new uses and/or users of self-shielded sources possessed by USNA that can be considered routine.
- g. Local USNA licenses are valid for a period not to exceed (NTE) five (5) years after which time a new application must be completed and submitted for renewal of the license. The renewal submission must be made 5 years from the USNA RSC Chair approval date (date of final signature) to which the document will have been received as a timely file. The license will remain valid during the review process.
- h. The USNA RSC may modify, suspend, or revoke a license at any time after it has been approved. In this case, all changes and representations made by the licensee will be incorporated into the original license application.
- i. USNA Local Authorizations/licenses are valid for activities performed on the USNA campus only. This authorization may not be transferred to another institution, nor will a license obtained at another institution be honored at the USNA. A licensee is required to comply with all pertinent Navy and Federal regulations and Local policies until such time that their radioactive

material license is officially terminated. **Termination of a license requires the following conditions be met:**

(1) The licensee will submit a letter of intent to terminate use of radioactive materials to the RSO.

(2) All radioactive material in the possession of the licensee is surrendered to the Radiation Safety Office, or is physically transferred, with the approval of the RSO, to an individual licensed to possess the material.

(3) The licensee's laboratory/equipment has been surveyed by the Radiation Safety Office for contamination.

(4) All contamination must be removed prior to release as unrestricted area.

(5) The letter of release will be sent to the licensee and the departmental chair.

CHAPTER 6  
USNA TRAINING PROGRAM

1. Training Overview. Training requirements and classifications for USNA organization personnel are specified in reference (a) Section 2.8.

a. USNA RASP implements training internally rather than contracting with outside businesses. USNA faculty and staff generally have a greater in-depth understanding and experience with radioactive materials and machine sources than what is available from commercial training companies. Nevertheless, for purchases of new machine sources, initial training on the maintenance and basic operation of the machine is required from the vendor as part of the installation service.

b. The USNA RSO and the USNA RSC have the responsibility for reviewing and approving the adequacy of all training. The Radiation Safety Office will hold the required periodic training sessions and designate instructors for all training sessions.

c. Radiation safety training must ensure that personnel are aware of radiation safety fundamentals and requirements, procedures to maintain radiation exposure ALARA, and procedures to reduce potential for exposure to radioactive contamination (if applicable). Occupationally exposed workers must receive initial training before beginning work with or around RASP radiation sources. The duration of the initial training will be determined by the RSO and modified as needed based on changes required by the USNA RSC.

d. The RSO has the authority to qualify and designate individuals in writing to perform or oversee training requirements.

2. Training Classifications at USNA.

a. Command Management/Leadership. This class applies to the Commanding Officer of USNA, referred to as the Superintendent. As per reference (a) Section 2.8.2, the Superintendent is required to complete the annual RASP Leadership Course (S-NKO-0001) available at the NAVSEA DET RASO Navy Knowledge Online website within the first six months of assuming command and annually thereafter. Copies of training completion certificates are to be forwarded to the RSO for record retention. The Superintendent may designate other supporting management to also complete the above course.

b. RSO and ARSOs. RSO/ARSO must receive training commensurate to meet or exceed the requirements required by NAVSEA DET RASO, NRC, and DOT per reference (a) Section 2.8.3. USNA must provide adequate time and resources to maintain RSO/ARSO continuing education and certifications.

c. Radiation Workers. Radiation workers are individuals who receive exposure to ionizing radiation in the course of their employment or duties and are identified by their command as being occupationally exposed. Normally, these individuals' routine duties require working directly with sources of ionizing radiation and have a significant potential for exposure. Faculty,

laboratory technicians, and postdocs are most commonly assigned to this classification. Training for radiation workers is outlined in reference (a) Section 2.8.4.

d. **Non-Radiation Workers.** Workers who receive very low-level radiation exposure incidental to their employment at the USNA but not as an integral part of their skill, trade or work assignment. Their assigned duties do not involve the direct use of RASP sources of ionizing radiation. These individuals may regularly access areas near or adjacent to RASP sources and may periodically be in radiation areas. Examples include students, faculty, staff, supervisors, management personnel, safety inspectors, radiation health personnel, gas chromatograph operators, maintenance personnel, delivery personnel, messengers, security personnel, firefighters, medical personnel, emergency response personnel and inspectors. Training for non-radiation workers is outlined in reference (a) Section 2.8.6. Radiation safety training for non-radiation radiation workers should also be specific to the areas and hazards that the individual could reasonably encounter.

e. **Members of the General Public and Other Organizational Personnel Working in Proximity to RASP Controlled Areas.** This classification could include other technical staff, students working in a laboratory but not using equipment or material sources, and staff involved in purchasing or receiving machines. Training for Members of the General Public and Other Organizational Personnel Working in Proximity to RASP Controlled Areas is outlined in reference (a) Section 2.8.7.

f. **Radioactive Material Shipper Training.** Individuals involved with the preparation and shipment of Class 7 (Radioactive) Material for transportation by any mode, military or commercial, will receive initial and refresher training per reference (a) Section 2.8.8.

g. **Government Purchase Card Holder (Government Purchasing Agent).** Individuals involved in the procurement of radiological materials and machine sources for USNA must have written approval by USNA Radiation Safety Office and USNA RSC prior to purchasing any radiological materials and machine sources.

### 3. Radiation Worker Requirements.

a. All members of the USNA RSC will be required to participate in Radiation Worker training to ensure a level of expertise necessary to review RASP processes. However, USNA RSC members are not required to undergo Radiation Medical examinations.

b. Radiation Medical examinations are required for all radiation workers per reference (b) through NMRTCA.

(1) Preplacement examination must be completed prior to assignment

(2) Routine examinations will be completed as follows:

(a) Every 5 years up to age 50

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(b) Every 2 years up to age 60

(c) Annually after age 60

(3) Termination examination must be completed within 6 months prior to separation or termination.

c. Radiation Worker Initial Training must include the following topics: (Annual Training Topics denoted by an asterisk\*)

(1) Operating, maintenance, handling, and accountability procedures for the devices or radioactive sources used (including command specific procedures\*).

(2) Radiation exposure limits, annual limits on intake (ALIs), and ACLs.

(3) Command specific RADIAC survey instrument requirements and operating procedures.\*

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

(5) Command specific personnel dosimetry, internal monitoring, and/or bioassay requirements.\*

(6) Biological effects and risks associated with exposure to ionizing radiation from internal or external sources.

(7) Sources and characteristics of ionizing radiation (i.e., alpha, beta, gamma, neutron).

(8) Command specific procedures for using time, distance, and shielding to maintain individual exposures ALARA.\*

(9) If applicable, use of respirators or forced air systems to limit internal deposition of radioactive materials.

(10) Responsibilities of individuals.\*

(11) Emergency procedures.\*

(12) Biological effects of radiation exposure to the embryo/fetus.\*

(13) Results of command internal audits, inspections, and Quality Management reviews.\*

(14) Reporting of deficiencies into the command's RASP Deficiency Report (RDR) program.\* (Annual Training must include "Problem trends and incidents that occurred since the last annual training.")

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(15) Each individual is responsible for tracking his/her own radiation exposure and exposure reports that are provided by the command.\*

(16) Notices required by 10 CFR 19 for NRMP operations regulated under the Navy Master Materials License (MML).

4. Non-Radiation Worker Requirements. Non-radiation workers make up the largest population of RASP workers at USNA. Non-radiation workers include:

a. Laboratory Managers that use exempt quantity radioactive materials or low exposure machine sources.

b. Faculty or Staff who use exempt quantity radioactive materials or low exposure machine sources.

c. Midshipmen that participate in laboratory classes that use exempt quantity radioactive materials or research where radioactive materials or machine sources are used.

d. Non-Radiation Worker Initial Training must include the following topics: (Annual Training Topics denoted by an asterisk\*)

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

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

(3) Biological effects and risks associated with exposure to ionizing radiation from internal or external sources.\*

(4) Use and meaning of radiation warning signs and barriers.\*

(5) Procedures to avoid and reduce radiation exposures.\*

(6) Personnel dosimetry, bioassay and/or internal monitoring requirements.\*

(7) Biological effects of exposure to the embryo/fetus if the person will receive greater than 100 mrem per year.\*

(8) Each individual is responsible for tracking his/her own radiation exposure and exposure reports that are provided by the command.\*

CHAPTER 7  
AUDITS, SURVEILLANCES, AND RASP PROGRAM RECORDS

1. RASP Audit Program Overview. Per reference (a) Section 2.9.1.1, a formal audit program must be established and command endorsed. The purpose of the Audit Program at USNA is:

- a. To encompass compliance and performance-based reviews
- b. To improve RASP safety
- c. To reduce RASP program violations
- d. To prevent mishaps and near-misses from occurring
- e. To review RDRs and analysis to detect any trends

2. RASP Audit Requirements. Per reference (a) Section 2.26.6.1, audits must be documented to clearly articulate observed discrepancies, negative trends, and improvement items. The command will be responsible for addressing each finding identified. The command must develop short and long-term corrective actions, and evaluate the effectiveness of the prior corrective actions. RASP audit records must include:

- a. The audit date(s).
- b. The name of the person(s) conducting the audit.
- c. The names of the persons contacted by the auditor(s).
- d. The areas audited (including a listing of records reviewed, number of records reviewed, and operations observed).
- e. All findings.
- f. The organization responsible to address each finding.
- g. A copy of the formal plan used to conduct the audit program.
- h. Records of audits, audit responses, and records of action completion will be maintained for a minimum of three years from the date of completion per reference (a) Section 2.29.6.5.

3. RASP personnel responsibilities in the Audit Program.

- a. (Assistant) Radiation Safety Officer

(1) Every 6 months, the RSO will conduct a radiation protection audit per reference (a) Section 2.9.1.6. The audit should include the following topics:

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

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

(c) Required radiation medical examinations are properly conducted at required intervals.

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

(e) Exposure information is provided to workers.

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

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

(h) Radioactive material transportation, shipping, receipt, transfer, and disposal records are properly maintained.

(i) RASP related training is properly conducted and documented.

(j) Deficiencies identified during previous evaluations, inspections, reviews, audits, and RDRs have been corrected and that corrective actions are effective.

(2) The RSO radiation protection audit will be command reviewed by the Superintendent per reference (a) Section 2.9.1.8.

(3) A Radiation Protection Audit (example) for RSO use is available in Appendix D.

(4) On an annual basis, the RSO, with input from USNA RSC and Licensees, will be responsible for completing an annual program review in compliance with reference (a) Section 2.10 (Annual Program Reviews). The report will be reviewed by the USNA RSC to ensure compliance. The report must include:

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

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

(c) Identification of any improvements to the RASP.

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

(e) A review of personnel exposure records that includes the individuals with the five highest annual radiation doses, those individuals with annual doses above 100 mrem (1 mSv), and the cumulative radiation dose total for all radiation workers.

(f) A list of personnel who had their ACL raised and their resulting radiation exposures.

(g) A review of all RASP related training.

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

(i) The results of the annual RDR trend report conducted by the RSO.

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

(k) A summary of RASP operation surveillances and results.

(l) A review of audit findings, responses, and audit effectiveness.

b. Radiation Safety Committee (USNA RSC)

(1) The USNA RSC will conduct a full review of the RASP annually in compliance with reference (a) Section 8.3.1.9.

(2) The USNA RSC will assign quarterly assignments including program audits to evaluate program compliance throughout the year in preparation for the annual review.

c. Licensee or Laboratory Manager. The Licensee will complete audits quarterly as custodian of a radiological laboratory. The areas of evaluation may include:

(a) Training compliance and records per reference (a) Section 1.5.2.4.c and Section 2.26.5.

(b) Review of Local Authorizations or SOPs.

(c) Completion of Laboratory Surveillances.

(d) Completion of Laboratory Radiation Surveys and/or Leak Checks as applicable.

(e) Completion of Inventory (reference (a) Section 2.13.3.1-2 and recorded per reference (a) Section 2.26.12-13)

(f) Review Operating and emergency procedures (reference (a) Section 1.5.2.4.b)

4. Licensee or Laboratory Manager Responsibilities. Upon approval by the USNA RSC through the Local Authorization process, a licensee or laboratory manager assumes responsibility of safely maintaining the radiological laboratory. The Licensee must:

a. Complete the RASP training annually and confirm that all authorized users are up to date on RASP training. (refer to Chapter 6)

b. Complete radiation surveys in accordance with reference (a) Section 2.21.2 or as specified in School Endorsed USNA Standard Operating Procedures.

c. Complete radioactive material inventory every 6 months.

d. Conduct quarterly surveillances in accordance to reference (a) Section 2.9.2.

e. Conduct quarterly audits in accordance to reference (a) Section 2.9.1.

f. Review the Local Authorization and SOP (as applicable) annually to ensure compliance.

g. Renew Local Authorization and SOP (as applicable) every 5 years to ensure compliance.

5. RASP Surveillance.

a. A Laboratory Manager or Licensee responsible for operations subject to RASP controls must conduct and document a surveillance of operations at least quarterly. Each type of RASP operation at a command (e.g., industrial radiography or instrument calibration services) will have a separate surveillance performed quarterly if operations are conducted. Surveillances should include observation of work in progress.

b. The RSO will review the findings of supervisor surveillances.

c. The surveillance conducted by the supervisor and the surveillance conducted by the RSO must not be performed by the same individual in the same quarter.

d. Deficiencies or improvement items noted during surveillances will be documented on an RDR per reference (a) Section 2.11.

e. RASP surveillance records will be maintained per reference (a) Section 2.26.6:

(1) The surveillance date(s).

(2) The title of the person(s) performing the surveillance.

(3) The title of the person(s) under surveillance.

(4) A description of the areas or processes observed.

(5) A statement discussing the outcome of the surveillance including any findings and/or actions resulting from the surveillance with actual or proposed dates of completion.

(6) Surveillance records will be maintained for a minimum of 3 years per reference (a) Section 2.26.6.7.

f. Additional RASP personnel responsibilities:

(1) RSO will complete quarterly surveillance of the USNA RASP program.

(2) The USNA RSC will assign quarterly assignments including program surveillances to evaluate program compliance throughout the year in preparation for the annual review.

#### 6. RASP Inventory.

a. The RSO must maintain a current inventory of all radioactive material authorized by NRMP(s), radioactive sources authorized by NRC general license (e.g., radioactive chemical reagents and some gauges), exempt instrument check sources, low level radioactive waste (LLRW), and radiation producing machines and devices possessed by the command (reference (a) section 2.13.3.1).

b. Under the direction of the RSO or ARSO, the command will conduct a physical (hands on) inventory of the items described in reference (a) Section 2.13.3.1 semiannually, unless specified otherwise in this manual or the NRMP for the command.

c. Radioactive material scheduled for disposal must be clearly identified as such in the inventory.

d. The RSO will provide the inventory required by reference (a) Section 2.13.3.1, by facility and location, to appropriate security and fire departments at least annually or when changes occur.

e. Material inventory records must contain the following information, as applicable, at a minimum (reference (a) Section 2.26.12):

(1) The manufacturer, model, and serial number of each sealed source and/or device, as applicable.

(2) A source identification number (if no serial number is available).

(3) The radionuclide identity.

- (4) The radionuclide chemical and physical form.
- (5) The quantity of source(s) on hand.
- (6) The activity per source as follows:
  - (a) For sources report in curies (becquerels);
  - (b) For depleted uranium, natural uranium, U-233, U-235, U-238 and plutonium quantity will be specified in units of mass (i.e. kg);
  - (c) Thorium will be reported in units of mass (i.e. kg or g) if reported under reference (e) Part 40. Discrete Thorium sources (for example, sealed sources or button sources) may be reported in curies (becquerels).
- (7) The activity determination date.
- (8) The source and/or device location.
- (9) The custodian's name (i.e. person in possession of the source).
- (10) The physical inventory date(s) (i.e. hands on location date(s)).
- (11) The name of the person(s) conducting the inventory.
- (12) The date the RSO reviewed the inventory record and his/her signature.
- (13) Source inventory records will be maintained indefinitely per reference (a) Section 2.26.12.3.

f. Machine inventory records must contain the following information at a minimum (reference (a) 2.26.13):

- (1) The physical inventory date(s) (i.e., hands on location date(s)).
- (2) The name of the person(s) conducting the inventory.
- (3) The manufacturer, make, model, and serial number of each machine.
- (4) The location of each machine.
- (5) The custodian's name (i.e., person in possession of the machine).
- (6) The date the RSO reviewed and signature.

(7) Machine source records will be maintained for five years after the date of the record per reference (a) Section 2.26.13.2.

7. Utilization Logs.

a. Utilization logs must be used and maintained per reference (a) Section 2.15.1.1.

(1) Use of all unsealed radioactive material and source material.

(2) Use of sealed radioactive sources, with activities greater than 10 times the quantities listed in reference (e) Part 20 Appendix C.

(3) Radioactive check sources used for instruments.

(4) Use of all registered radiation producing machines and devices.

b. Utilization logs for radioactive material must contain at a minimum (reference (a) Section 2.26.15.1):

(1) The source serial number.

(2) The name(s) of individual(s) using the source.

(3) The use date and time.

(4) The use location.

(5) The date the source is returned to storage (if the source is removed from the normal storage area).

(6) The quantity of activity used and its disposition (for unsealed sources).

(7) The date the RSO reviewed the utilization log and their signature.

(8) Radioactive material utilization logs will be maintained for 3 years after date of last entry per reference (a) Section 2.26.15.3.

c. Utilization logs for machine sources of ionizing radiation must contain at a minimum (reference (a) Section 2.26.16.1):

(1) The machine manufacturer, make, model, and serial number(s).

(2) The use date and time.

(3) The use location.

- (4) The radiation exposure time length.
- (5) the maximum and operating voltage (kVp) and current (mA).
- (6) The target material if applicable.
- (7) The name and signature of the operator.
- (8) The date the RSO reviewed the utilization log and their signature.

(9) Machine source utilization logs will be maintained for 5 years after date of generation reference (a) Section 2.26.16.3.

d. The utilization log for an accelerator must be maintained per reference (a) section 12.1.12.2.b as follows:

- (1) Machine identification.
- (2) Energy, current or radiation output, duration of operation and date.
- (3) Primary beam orientation.
- (4) Name(s) of the operator(s) and signature of the Senior operator.
- (5) Model, serial number, and calibration dates of survey instruments.
- (6) Initials of the operator verifying that the radiation survey instruments have been sources checked prior to the initial exposure of the day or shift.
- (7) Initials of the operator certifying that all interlocks and alarms have been checked for proper operation before the initial exposure of the day or shift.

## 8. RASP Surveys.

### a. Radiation Protection Surveys.

(1) Radiation protection surveys are conducted to determine radiological conditions before, during, and after radiological work. Surveys must be of sufficient frequency and detail to ensure personnel radiation exposures and radioactive material are properly controlled per the requirements of reference (a) and NRMPs (reference (a) Section 2.21.1.1).

(2) Radiation surveys must be conducted (reference (a) Section 2.21.2.a):

(a) Weekly in the vicinity of temporary radiation area boundaries. Ropes across building openings, such as a door, do not require weekly survey.

(b) Monthly in occupied radiation areas, high radiation areas, radioactive material storage areas, and areas adjacent to these areas.

(c) At least annually in unoccupied radiation areas, high radiation areas, and radioactive material storage areas even if the area must be opened to perform the survey.

(d) Annually on ventilation systems used in support of radioactive contamination work or to control airborne radioactivity.

(3) Radiation Survey Records. Radiation survey records must include the following information as at a minimum (reference (a) Section 2.26.19.1).:

(a) The survey date and time.

(b) The name of the person(s) conducting the survey.

(c) The nomenclature for the radiation source and installation (e.g., sealed or machine source model and serial numbers; and building name or number and room number).

(d) The identity of the radiation survey instruments used, including model and serial numbers, and dates of last calibration.

(e) The source intensity in roentgens per hour at one meter or source activity in curies for a beta-gamma source.

(f) The radiation source location at the time of the survey.

(g) The date the RSO reviewed the survey and his or her signature.

(h) Radiation survey records will be maintained indefinitely per reference (a) Section 2.26.19.3.

**b. Contamination Surveys.**

(1) Each licensee is responsible for performing routine surveys for contamination in locations, under his/her supervision, where unsealed sources of radioactive material are handled. These surveys must be in the form of wipe tests which will be taken and counted utilizing a procedure which incorporates the following:

(a) Wipe tests must be made of all surfaces where radioactive materials are handled, and in other locations which have a risk of becoming contaminated (e.g. sinks, refrigerator or freezer handles, telephones, etc.).

(b) Each wipe test must cover an area no greater than 100 square centimeters one square foot, and the number of wipe tests taken per survey must be sufficient to ensure that any contamination within the work area is detected.

(c) Wipe tests must be assayed on a calibrated counting instrument in such a way as to detect contamination levels of 200 disintegrations per minute (dpm) on each sample.

(d) Wipe tests for contamination with alpha, beta, or gamma emitters must be counted using:

1. Gas proportional counter

2. Liquid scintillation\*

3. Gamma counter using a NaI crystal\*

4. Approved alpha/beta survey instruments following NAVSEA Radiac Program Office.

\*Counter for which the counting efficiency (cpm to dpm conversion factor) is known for the radionuclide (either by using reference standard or manufacture provided), counting configuration, and counting cocktail used (LSC only).

(e) The results of wipe test surveys will be entered on the document provided by the Radiation Safety Office or Licensee generated document approved by the RSO. Positive results must be recorded in units of disintegrations per minute.

(f) Wipe test samples which give a count rate in excess of twice the background level must indicate the presence of contamination.

(g) Contamination surveys described in this section, will be performed at the following frequency for unsealed radioactive materials greater than exempt quantities:

1. Daily, in occupied radioactive contamination areas, control point areas, and areas immediately adjacent to control point areas. Surveys need only be conducted on days when work in the area with unsealed sources or contaminated equipment is performed.

2. Monthly, in all areas of facilities where contaminated or potentially contaminated materials are used or stored.

3. Perform contamination surveys in plenums downstream of HEPA filters in ventilation systems used for radioactive contamination work to check for buildup of radioactivity in ducting. These surveys must be performed during filter changes or at least annually for systems that have been used during the previous year.

4. Perform surveys of areas where spills of radioactive liquid have occurred or airborne radioactivity has exceeded the derived air concentrations of reference (e) Part 20 Appendix B to determine the need for protective clothing and the extent of the contaminated area.

5. Special contamination surveys will be performed immediately whenever contamination is suspected.

(2) Spot checks for personal and area contamination should be performed between routine contamination surveys. Spot checks may be performed using a GM survey meter having a probe with a window sufficiently thin to allow detection of the radionuclide(s) being surveyed.

(3) Decontamination procedures must be initiated immediately whenever a contamination survey or spot check yields positive results. The trigger levels for removable contamination surveys in research laboratories are 200 dpm per 100 cm<sup>2</sup> for all radionuclides with the exception of alpha emitting radionuclides, which has a trigger level of 20 dpm per 100 cm<sup>2</sup> above background levels.

(4) Each licensee who "uses" at any one time, quantities > 200 microcuries of unsealed sources of gamma or energetic beta emitting radiation must perform area surveys of radiation levels in his/her work area and document the results. These surveys must incorporate the below procedures:

(a) Area surveys will be performed using a NAVSEA DET RASO approved instrument calibrated by a NIST traceable source. which reads in exposure units of mR/hr.

(b) The locations surveyed will include shield surfaces, storage units, worker locations with source(s) unshielded, the unshielded source surfaces, and adjacent unrestricted areas.

(c) The results of ambient radiation level survey will be entered in units of mR/hr onto the log provided by the Radiation Safety Office.

(5) Spot checks of radiation levels should be made at the start of new procedures involving sources of penetrating radiation and whenever significant or unpredictable changes in the radiation exposure rate are possible.

(6) Contamination Survey Records. Contamination survey records will include the following information as at a minimum (reference (a) Section 2.26.18.1):

(a) The survey date and time.

(b) The survey location.

(c) A diagram of area surveyed.

(d) The locations of contamination readings/wipes.

(e) The instrument efficiency for the radionuclide of concern.

- (f) The gross and net count rates.
- (g) The background count rate.
- (h) All observed contamination levels (in terms of activity).
- (i) A description of the instrument(s) used to include model number and serial number.
- (j) The last calibration date for each instrument used.
- (k) The name of the individual(s) who performed the survey.
- (l) The date the RSO reviewed the contamination survey and his/her signature.

c. Additional Survey Considerations.

(1) The USNA Radiation Safety Office must be contacted whenever an area survey reveals a radiation level where an individual member of the public can receive a dose greater than 2 millirem in any one hour or discovery of an area meeting the requirements of a radiation area where a person receives an estimated unmonitored exposure of greater than 2 millirem. If an evolution is anticipated to result in an exposure in excess of 2 millirem in any one hour, the user will request pre-approval to operate from the RSO prior to commencement of operation/use of the device/source.

(2) Surveys for airborne radioactivity must be undertaken whenever a licensee performs a procedure which may result in the release of radioactive fumes, vapors, or aerosols. Air surveys will be made under the supervision of the USNA Radiation Safety Office which will provide the sampling device and the appropriate filters, and will select the locations from which air samples are taken. The calculations of airborne concentrations, based on air sampling results, will be made by Radiation Safety Office.

9. Leak Tests.

a. General Requirements.

(1) Leak test samples must be taken from the source or an adjacent surface where contamination is expected to accumulate per reference (a) Section 2.19.2.1. For example, sources that emit alpha particles that may be plated with a Mylar cover will only be tested by wiping an adjacent surface and not the source directly per reference (a) Section 2.19.2.2.

(2) Licensees authorized to possess sealed sources of beta/gamma radioactivity in amounts greater than 100 microcuries per source must perform leak tests on these sources at six (6) month intervals or as dictated by the SSDR per reference (a) Section 2.19.1.1. Each leak test sample must be assayed on a counting system capable of detecting 0.005 microcuries of

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removable radioactivity per reference (a) Section 2.19.2.5. The RSO must be contacted whenever a leak test yields positive results.

(3) Sealed sources must be tested for leakage and/or contamination at intervals not to exceed the intervals specified in the certificate of registration issued by the U.S. Nuclear Regulatory Commission under reference (e) Part 32.210 or under equivalent regulations of an Agreement State. Notwithstanding the paragraph above, sealed sources designed to primarily emit alpha particles will be tested for leakage and/or contamination at intervals not to exceed three (3) months.

(4) In the absence of a certificate from a transferor indicating that a leak test has been made within the intervals specified in the certificate of registration issued by the U.S. Nuclear Regulatory Commission under reference (e) Part 32.210 under equivalent regulations of an Agreement State, prior to the transfer, a sealed source received from another person will not be put into use until tested and the test results received.

(5) Sealed sources need not be tested if they contain only hydrogen-3; or they contain only a radioactive gas; or the half-life of the isotope is 30 days or less; or they contain no more than 100 microcuries of beta and/or gamma-emitting material or not more than 10 microcuries of alpha-emitting material.

(6) Sealed sources need not be tested if they are in storage and are not being used; however, when they are removed from storage for use or transferred to another person and have not been tested within the required leak test interval, they must be tested before use or transfer (reference (a) Section 2.19.1.5). No sealed source will be stored for a period of more than 10 years without being tested for leakage and/or contamination.

(7) The leak test must be capable of detecting the presence of 185 becquerels (0.005 microcurie) of radioactive material on the test sample. If the test reveals the presence of 185 becquerels (0.005 microcurie) or more of removable contamination, the RSO must be immediately notified and a report per reference (a) Section 2.19.3 will be made and the source will be removed immediately from service and decontaminated, repaired, or disposed of in accordance with Nuclear Regulatory Commission regulations.

b. Training. To be designated as qualified for performing leak tests, the following must be met:

(1) The individual has completed Radiation Worker Training and the training is completed annually.

(2) The individual has completed all requirements by NRMTC, deemed medically eligible, and has been assigned the appropriate dosimetry devices.

(3) The individual has completed applicable training, authorizations, and is designated as an "Authorized User".

c. Procedure. The Leak Test program implemented will be modeled after reference (d) Appendix M. A detailed leak test procedure must be written in the standard operating procedures maintained by the licensee and approved by the divisional management. A summary of the procedure is as follows:

- (1) Start up and calibrate the instrument per manufacturer instructions.
- (2) Obtain the materials for the wipe sample and label each sample wipe appropriately (For example: list the name of the source and location; remember to include a background sample)
- (3) As necessary with the appropriate security precautions, open the door ways that may need to be accessed to minimize any contamination while moving from source to instrument.
- (4) Obtain the appropriate PPE including gloves.
- (5) Begin taking wipes where the most contamination could accumulate in the case of source leakage. The wipe should encompass 100 cm<sup>2</sup>.
- (6) Place the sample wipes on a secondary surface near the instrument.
- (7) Using the instrument parameters, begin recording the counts per wipe and determine the net count rate per sample.
- (8) Determine the activity of the sample. If the activity of the sample is greater than 0.005 microcurie or (185 Bq) notify the RSO immediately.

d. Leak Test Records. Leak test records must include the following information at a minimum (reference (a) Section 2.26.17.1):

- (1) The identity of each source or device (e.g., source or device manufacturer, model number, serial number, isotope, and quantity).
- (2) The identity of the command possessing the source.
- (3) The leak test date and next scheduled leak test date.
- (4) The leak test methods used (e.g., dry filter paper or wet cloth swipe and areas wiped).
- (5) The leak-test results expressed in units of becquerels (microcuries) for each area wiped.
- (6) A description of the equipment used to analyze the leak test (e.g., counting instrument manufacturer, model number, and serial number), if provided or available.
- (7) The name of the organization performing the test.

- (8) The name and dated signature of the certifying individual.
- (9) Leak test records will be maintained indefinitely per reference (a) Section 2.26.17.3.

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## CHAPTER 8

### SURVEY INSTRUMENT TYPES

1. Survey Devices and Experimental Equipment. The instruments included in the laboratory fall into two general categories: survey devices and experimental equipment. The first group includes portable instruments or devices: and calibrated portable survey meters (alpha, beta, gamma and neutron); The second includes stationary systems or equipment: neutron detection probes (BF<sub>3</sub> and <sup>3</sup>He), rem-meters, gas flow detectors, Geiger-Mueller detection systems, neutron or alpha or gamma spectrometer systems, scalar-timers, analytic balances, a and a Far West Tissue Equivalent Proportional Counter instrument called the HAWK. A neutron howitzer is also located in the laboratory.

#### 2. Navy RADIACs (Radiation Detection, Indication, and Computation)

a. All primary radiation monitoring instruments used for official radiation field records are available in reference (f). Instruments not listed in reference (f) must obtain approval from NAVSEA DET RASO. RADIACs are calibrated by the NAVSEA Calibration Laboratory (WAJ).

b. The U.S. Naval Academy has risks from photon, neutron, and alpha radiation which will be monitored using NAVSEA DET RASO-approved RADIACs. Items in the current RADIAC allowance for USNA are given in Table 8-1 below with the calibration frequency. Changes to calibration frequency are only through approval from NAVSEA Calibration Laboratory (WAJ).

**Table 8-1 – RADIACs approved for use at USNA**

| <b>Model Number</b>                                                             | <b>Common Names / Purpose</b> | <b>Calibration Frequency (months)</b> |
|---------------------------------------------------------------------------------|-------------------------------|---------------------------------------|
| AN/PDR-70                                                                       | Neutron, “snoopy”             | 12                                    |
| DT-304/PDR                                                                      | Beta/Gamma – “Frisker”        | 12                                    |
| DT-680/PDQ                                                                      | Beta/Gamma                    | 12                                    |
| DT-681/PDQ                                                                      | MFR Alpha probe               | 12                                    |
| DT-685/PDQ                                                                      | MFR Beta probe interface      | 12                                    |
| EPD (orange)                                                                    | Electronic personal dosimeter | 12                                    |
| IM-265/PDQ (PDQ-1)                                                              | Geiger-Mueller counter        | 12                                    |
| IM-265/PDQ (PDQ-5)                                                              | Geiger-Mueller counter        | 12                                    |
| MX-12132/S                                                                      | Source kit                    | N/A                                   |
| MX-12133/S                                                                      | Source kit                    | N/A                                   |
| IM-231/PD                                                                       | Ion Chamber                   | 12*                                   |
| N/A = not applicable                                                            |                               |                                       |
| * = dependent on use, frequency approved by NAVSEA Calibration Laboratory (WAJ) |                               |                                       |

#### 3. Non-Navy Instruments.

a. Facilities may require monitoring instruments with capabilities not available from the approved RADIAC list of reference (f). These may include instruments built into interlock systems, instruments with additional sensitivity, and instruments designed to monitor for specific radioisotopes.

b. Reference (d) Appendix H provides information on the choice of proper radiation detection equipment for various radiological conditions. The table is partially reproduced below.

**Table 8-2 – Typical Survey Instruments**

| Detector Type                | Radiation       | Energy Range                         | Efficiency |
|------------------------------|-----------------|--------------------------------------|------------|
| Exposure Rate Meters         | Gamma,<br>X-ray | $\mu\text{R} - \text{R}$             | n/a        |
| Geiger-Mueller               | Alpha           | All energies (dependent on window)   | moderate   |
|                              | Beta            | All energies (dependent on window)   | Moderate   |
|                              | Gamma           | All energies                         | <1%        |
| NaI Scintillator             | Gamma           | All energies (dependent on crystal)  | Moderate   |
| Plastic Scintillator         | Beta            | C-14 or higher (dependent on window) | Moderate   |
| Liquid Scintillation Counter | Alpha           | All energies                         | High       |
|                              | Beta            | All energies                         | High       |
|                              | Gamma           | All energies                         | Moderate   |
| Gamma Counter (NaI)          | Gamma           | All energies                         | High       |
| Gas Proportional             | Alpha           | All energies                         | High       |
|                              | Beta            | All energies                         | Moderate   |
|                              | Gamma           | All energies                         | <1%        |

c. NAVSEA DET RASO will approve the use of any radiation detection instruments not listed in reference (f) prior to use. Requests for approval of non-standard instruments will include a detailed description of the instrument and its characteristics, methods, and procedures for calibration, and procedures for use and pre-use checks. USNA will operate under the calibration frequency provided by the manufacturer unless otherwise noted.

4. RADIAC Response Check. Per reference (a) Section 2.12.2.2.e, all RASP RADIAC instruments must be response checked using appropriate radioactive sources either daily or before use. RADIACs must also be response checked upon receipt from the calibration laboratory. The following outlines the guidelines for a proper RADIAC response check.

a. RADIAC response upon receipt of RADIAC shipment:

- (1) Complete a visual inspection of the RADIAC, note the integrity.
- (2) Insert the batteries of the RADIAC and complete the battery check.

(3) Turn on the RADIAC (the radiation level should be at 0).

(4) Using a Navy approved radiation check source kit, place the RADIAC on the appropriate source and record the response. The RADIAC response log must include the following:

- (a) RADIAC model and serial number
- (b) Calibration date and calibration due date
- (c) Radiation Check Source Kit serial number
- (d) Check source isotope
- (e) Initial response (including response  $\pm$  20%)

b. RADIAC response for daily use:

- (1) Record the date.
- (2) Name of User.
- (3) Integrity Check and visual inspection.
- (4) Battery Check
- (5) Observed Radiation Level (compare to initial response).

c. Per reference (a) Section 2.26.9, RADIAC response records will be maintained for three years.

CHAPTER 9  
PROCUREMENT, MATERIAL SHIPPING, MATERIAL RECEIPT, DISPOSAL, AND  
DECOMMISSIONING

1. Procurement. All acquisitions of radioactive material and ionizing radiation production devices, whether through purchase or transfer from another authorized licensee, will be arranged through the Radiation Safety Committee. This includes the licensee preparing a local authorization for the USNA RSC to review that contains information from Chapter 5 Section 2.

a. General Requirements.

(1) Commands will establish written procedures to ensure USNA RSC and RSO approval of the acquisition of any source of ionizing radiation including those from radioactive materials and radiation producing machines and devices. Specifically,

(a) The USNA RSC will be notified in writing in advance of the procurement of all radiation sources (ionizing radiation producing machines, radioactive material requiring a NRMP or accelerator produced radioactive material) and the medical (physical) qualifications, training and experience of proposed users.

(b) The USNA RSC will review and approve, in advance of procurement, proposed uses of sources of ionizing radiation.

(c) The USNA RSC will delegate authority to approve procurement, transfer, or disposal of radiation sources that are defined as routine.

(2) USNA RSC and RSO approval will occur prior to requisition, purchase, or transfer of ownership.

b. Radioactive Material.

(1) All acquisitions of radioactive materials, whether through purchase or transfer from another authorized licensee, must be arranged through the RSO.

(2) All requisitions for purchase of radioactive material must be approved by the USNA RSC before the purchasing department will issue a purchase order number.

(3) The RSO will approve a purchase requisition provided that:

(a) The requisitioner has an approved standard operating procedure which covers the radionuclide(s) and the chemical and physical forms requisitioned, therefore approved individuals will be referred to as a licensee.

(b) Acquisition of the radioactive material will not result in USNA exceeding the possession limits specified in its NRMP and will not result in the licensee exceeding the possession limit specified in their institutional license.

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(c) The requisition contains the following information:

1. The shipping instructions specify must specify shipment to

Radiation Safety Officer  
Rickover Hall – **Building, Room Number**  
590 Holloway Road  
US Naval Academy  
Annapolis, Maryland 21402

2. The radionuclide, chemical form, and activity to be purchased.

3. The vendor and catalog number; and Sealed Source and Device Registry Number (if greater than exempt quantity and sealed).

4. The requested delivery date.

(4) Requisitions for standing orders of radioactive material will be approved by the Radiation Safety Office provided that the requisition indicates an anticipated delivery schedule and number of shipments for each radionuclide, and the licensee confirms that prior shipments are depleted (i.e. have been disposed of) before a new shipment is received.

(5) Acquisition of radioactive material through transfer from another radioactive material licensee either inside or outside the institution will be approved by the RSO provided that the conditions identified for proper use and storage are met and permitted by the current NRMP.

(6) Authorized radioactive workers may not directly receive a shipment of radioactive material unless written authorization is received from the RSO. Incoming shipments of radioactive material will be routed directly to the USNA Radiation Safety Office, where they will be logged into a master inventory record and inspected for integrity, radiation levels, and proper labeling, before being released to the licensee. When the licensee has written authorization to directly receive packages, then he/she will be required to inspect the shipment following the procedures provided by the USNA Radiation Safety Office, and to notify the USNA Radiation Safety Office that the shipment has been received.

(7) Once under the control of the licensee, radioactive material must be secured in such a manner as to prevent unauthorized access or accidental exposure. The radioactive material must be locked in a cabinet, refrigerator, or freezer, safe, or security box which only individuals authorized to handle the material possess a key. Laboratories containing radioactive material will be locked when designated user/s are not present.

c. Ionizing Radiation Producing Devices (machine sources).

(1) All acquisitions of ionizing radiation production devices, whether through purchase or transfer from another authorized licensee, will be arranged through the RSO.

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(2) All requisitions for purchase of ionizing radiation production devices must be approved by the RSO or ARSO before the purchasing department will issue a purchase order number.

(3) The following instruments are examples of ionizing radiation producing devices.

(a) Machine X-ray producing equipment:

(b) X-ray Diffractometers

(c) X-ray Cabinet

(d) Industrial X-ray Radiography

(e) XRFs

(f) X-ray Spectrometer

(g) Scanning Electron Microscope

(4) The USNA RSC will approve a purchase requisition for machine sources provided that:

(a) The machine is registered with NAVSEA DET RASO in compliance with reference (a) Section 3.5.1 and the requisitioner has submitted a draft local authorization, which covers the ionizing radiation production device requisitioned, therefore approved individuals will be referred to as a licensee.

(b) The requisition contains the following information:

1. The shipping instructions specify the licensee's name and the complete address to the machine source's final destination on the USNA campus.

2. The ionizing radiation production device to be purchased including manufacturer and model number.

3. The vendor, catalog number, and item serial number (if available).

4. The requested delivery date.

(5) Requisitions for standing orders of ionizing radiation production devices will not be approved unless approved by the USNA RSC.

(6) Acquisition of ionizing radiation producing machines through transfer from another licensee from either inside or outside the institution will be approved by the USNA RSC provided that the conditions identified in use and storage are met.

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(7) Workers may not directly operate ionizing radiation producing devices unless authorization is received from the USNA RSC. The Radiation Safety Office must first review operating conditions identified for use and storage, perform initial radiation surveys, ALARA training, qualify authorized users as needed, and determine device is operating in accordance with reference (a) requirements conditions prior to releasing it for use to the authorized licensee.

(8) Once under the control of the licensee, ionizing radiation producing device will be secured in such a manner as to prevent unauthorized access or accidental exposure to non-radiation workers whereby only the licensee/authorized users possess a key (either physical or electronic). Laboratories containing ionizing radiation producing devices must be locked when designated user/s are not present. The USNA Radiation Safety Office will be promptly notified if there is a: malfunction, intended disposal, intended transfer/move of device, change in operator/operating conditions, or radiation safety incidents involving the ionizing radiation producing device.

## 2. Transportation of Radioactive Materials (RAM) at USNA.

a. The transportation of radioactive material by USNA employees in a personally owned vehicle is prohibited. If a vehicle transport is required, it can only be completed using a government vehicle upon approval from the USNA Radiation Safety Committee.

b. All radioactive material will be transported between approved facilities by trained personnel (radiation or non-radiation worker) by cart or delivered by hand. Approved facilities such as Hopper Hall (HP), Rickover Hall (RI), Michelson Hall (MI), and Chauvenet Hall (CH) are interconnected on the 0-deck allowing for ease in transport between buildings.

c. Special nuclear material or radioactive material with an increased exposure risk will be transported in accordance with Division endorsed standard operating procedures (SOPs) and/or installation reviewed security SOPs.

## 3. Shipping Requirements. The following outlines the minimal shipping requirements per reference (a) Section 2.22.2.

a. Training. Only certified Hazmat Class 7 shippers designated by the Superintendent are authorized to prepare, ship, and receive radioactive materials. (Chapter 6) USNA Radiation Workers may not directly receive a shipment of radioactive material or a machine source unless written authorization is received from the RSO. Incoming shipments of radioactive material will be routed directly to the Radiation Safety Office.

b. Shipping Address. The shipping instructions must specify shipment to:

Radiation Safety Officer  
Rickover Hall – **Building, Room Number**  
590 Holloway Road  
US Naval Academy  
Annapolis, Maryland 21402

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c. Shipments are required to be specially packaged so that the exposure to individuals is negligible. Nevertheless, USNA will treat the material in a manner so as to maintain exposures ALARA. The three ways to do this are:

(1) Minimize the time near the material

(2) Keep a distance from the material.

(3) Use shielding materials. The shipping containers are already prepared to assist with the third.

d. Preparation of shipments. All shipments should be prepared in accordance with reference (g).

(1) Classification – Determined by quantity and form

(2) Package – Determined by the type of hazard

(3) Marking - Identifiers related to package contents

(4) Labeling – Standardized hazmat identifiers

(5) Placarding – More durable hazmat identifiers placed on outer containers or vehicles for transport

(6) Shipment Papers – Provides an overview of the description of materials and includes emergency response phone numbers



**Figure 9-1 – Example of HAZMAT Labels**

#### 4. Receipt of Radioactive Materials.

a. During normal working hours,

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(1) Immediately inform the USNA Radiation Safety Office about the package to perform a survey. Most packages require a survey be completed within three hours of arrival.

(2) Each package must be visually inspected for any signs of shipping damage such as crushed or punctured containers or signs of dampness upon immediate receipt of any package known to include radioactive material. Do not touch any package suspected of leaking. Request the person delivering the package to remain until the arrival of the RSO or ARSO.

(3) The RSO or ARSO will notify the appropriate licensee.

b. Any deliveries outside normal working hours will be coordinated directly by the Radiation Safety Office.

c. To identify shipments for receipt that may have been misdirected, the common receiving areas in Rickover, Michelson, and Chauvenet Halls will have assigned personnel to identify radiological shipments. Once the misdirected package has been identified, the Radiation Safety Office will be contacted. In addition, the Radiation Safety Office will work with receiving areas to ensure that designated personnel are able to recognize the labels and markings associated with radiological packages. This includes the labels and markings shown in Figure 9-1 or that state UN2910 or UN2911.

d. Shipments will be inspected for integrity, radiation levels, and proper labeling. A radioactive material shipping and receiving report is completed by the Radiation Safety Office. The report includes:

(1) Receipt of shipment information.

(2) Radioactive material information.

(3) Package information.

(4) Package Survey results.

(5) Additional Documents retained.

e. Items will be logged into the master inventory record before being released to the USNA licensee.

f. When the licensee has written authorization to directly receive packages, then he/she will be required to inspect the shipment following the procedures provided by the RSO, and to notify the RSO that the shipment has been received.

h. Once under the control of the licensee, radioactive material must be secured in such a manner as to prevent unauthorized access or accidental exposure to the radioactive material must be locked in a cabinet, refrigerator, or freezer, safe, or security box which only individuals authorized to handle the material, possess a key.

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i. Laboratories containing radioactive material must be locked when designated user(s) are not present.

5. Disposal of Radioactive Materials and Machine Sources.

a. Disposal of radioactive material must be arranged through the Radiation Safety Office. Unless authorization is obtained to do otherwise, licensees will transfer all of their radioactive waste to the radioactive waste room located in USNA Rickover 75A (RI-75A). Long-lived radioactive waste will be coordinated through NAVSEA DET RASO. Short lived waste will be held for decay following the procedure described below.

b. The Radiation Safety Office will accept radioactive waste for disposal or interim storage, provided the following conditions are met:

(1) Radioactive waste will be pre-segregated into the below categories.

(a) Dry Solid Material (DSM) - which contains no pourable liquids or biological tissues or fluids of any kind.

(b) Large Volume Aqueous Liquids - which consists of containers having a volume in excess of 50 milliliters of aqueous, non-corrosive fluid.

(c) Small Volume Aqueous Liquids - which consists of containers having a volume of less than 50 milliliters of aqueous fluid.

(d) Scintillation Vials Exempt - which consists of vials containing liquid scintillation fluid with tritium and/or carbon-14 in concentrations less than 0.05 microcuries per milliliter.

(e) Scintillation Vials Regulated - which consists of vials containing liquid scintillation fluid with tritium and/or carbon-14 in concentrations greater than 0.05 microcuries per milliliter, or any other radionuclide concentrations greater than background.

(f) Each category of waste is marked with radionuclide, activity content, and licensee's name.

(g) The radiation exposure rate on the surface of the waste package does not exceed 50 mR/hr.

(h) The radioactive waste is accompanied by a signed requisition indicating to which licensee the disposal record will be applied to.

(i) The radioactive waste is brought for processing and packaging during the specified hours of operation of the radioactive waste room.

(j) Storage of radioactive materials for decay will only be performed at the radioactive waste room under the control of the Radiation Safety Office. Short lived radioactive waste will be stored for a minimum of ten half-lives and be free of detectable radioactivity, when monitored using a thin window GM survey meter, before it is released as normal trash. However, the Radiation Safety Office is permitted to process radioactive waste in accordance to with reference (e) Part 20.2005.

(k) The Radiation Safety Office will accept waste for “Decay in Storage” provided that the following conditions are met:

1. The radionuclide(s) have a half-life of less than 120 days.
2. Each package of radioactive waste has a volume less than 1 cubic foot.
3. Each package of radioactive material contains a maximum of 3 radionuclides.
4. The radioactive material is double bagged and has a permanent label indicating the radionuclide contained, the activity, and the licensee's name.
5. All radioactive warning labels must be defaced or removed prior to disposal for decay. (No radioactive labels inside the bag).
6. Radioactive waste is brought to the RSO for storage during the specified hours of operation.
7. Short lived radioactive waste may not be held for decay in the user's laboratories.
8. No licensee must dispose, or allow to be disposed of, any radioactive material through release with normal trash.
9. All disposable items used during radioactive procedures must be monitored for contamination before disposal as normal trash.
10. Radioactive warning labels must be removed or defaced prior to their disposal as normal trash.
11. Radioactive waste storage containers in laboratories must be conspicuously posted with a “radioactive materials” warning sign and a worded warning to housekeeping personnel not to remove the waste.
12. Disposal of radioactive material into the sanitary sewer system must not be performed, however, the licensee may wash lab ware (glass, plastic ware, etc.) if approved by Radiation Safety Office. The Radiation Safety Office will provide containers to collect liquid waste.

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13. Liquid radioactive waste will be picked up by the Radiation Safety Office or delivered by an authorized user to the radioactive waste room provided the below criteria are met.

a. The radioactive compound is readily soluble (or is readily dispersible biological material) in water.

b. The liquid waste is non-toxic.

c. Each radionuclide is maintained in a separate container and separated as short-lived and long-lived liquid waste.

d. All liquid waste containers are labeled with tags provided by the Radiation Safety Office. The tag must list the below information.

(1) Name of licensee

(2) Isotope

(3) Activity (microcuries)

(4) Chemical form (on reverse side of tag)

(5) Date of pick-up.

c. Disposal of Radiation Producing Machines (per reference (a) Section 2.25.2 and Section 3.5.8.1)

(1) Machine sources of ionizing radiation designated for disposal will be rendered inoperable (i.e., incapable of generating x-rays) to prevent the inadvertent exposure of unmonitored personnel.

(2) The RSO will approve the disposal of all machine sources of ionizing radiation at the command.

6. Decommissioning. Decommissioning is the process of making a system inoperable while ensuring decontamination of any radiological hazards. This section will describe the general guidelines of decommissioning facilities and equipment and the timing of these processes per reference (a) Section 3.4.

a. General requirements.

(1) Each command will maintain a historical file for each facility or outside area where radioactive material is stored or used containing the following information:

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(a) A listing of all areas designated and formerly designated as restricted areas (per reference (e) Part 20.1003) for the purpose of protecting individuals from the presence of radiation and radioactive materials.

(b) The record for each area must identify the radionuclide and amount of radioactivity, the makes and model numbers of devices or sealed sources used in the area, and a summary statement on the leak test history for each source or device for which leak tests were required.

(c) Historical records of licensed, accelerator produced, NRC exempt quantity radioactive material and radium.

(d) A listing of all locations requiring decontamination or that were decontaminated (including decommissioning documentation if the NRMP was not terminated).

(e) Records of information important to the safe and effective decontamination of the facility.

(f) Each command is responsible for all funding associated with its decommissioning operations.

(g) Each facility or area no longer used for licensed radioactive material storage or operations must be decontaminated to the criteria set in reference (e) Part 20 before being released for other than radiological operations or unrestricted use.

(h) The command will provide a decommissioning plan to the NRSC, via NAVSEA DET RASO, for approval before beginning decommissioning operations.

b. Timing of Decommissioning. (reference (a) Section 3.4.2 and reference (h))

(1) The facility or area decommissioning process commences when any of the following occurs:

(a) Thirty (30) days pass after the NRMP expires or is revoked.

(b) The command decides to permanently cease operations involving the use of permitted radioactive material at the entire site or in any separate building or outdoor area that contains residual radioactivity, such that the building or area is unsuitable for release in accordance with Navy, Marine Corps or NRC requirements.

(c) Twenty-four (24) months after principal activities involving permitted radioactive material are conducted (licensee decides to stop operating).

(d) No NRMP activities are performed in a separate building or outdoor area for a period of 24 months, and residual radioactivity is present that would preclude the building or area's release in

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accordance with Navy, Marine Corps or NRC requirements.

(2) The command must notify the NRSC, via NAVSEA DET RASO, within 60 days of any of the conditions listed above.

(3) The command will submit its decommissioning plan to the NRSC, via NAVSEA DET RASO, within 12 months of making notification that permitted operations have ceased.

(4) Decommissioning must be completed within 24 months of decommissioning plan approval by the NRSC.

c. Decommissioning Process. (reference (a) Section 3.4.3)

(1) The decommissioning process consists of a series of integrated activities that begin when a command notifies the NRSC of its intention to cease NRMP operations and end with NRMP or partial NRMP termination. Although steps may vary depending on local factors, the basic decommissioning process for all NRMP holders is similar.

(2) A command undergoing facility or site decommissioning must:

(a) Stop licensed radioactive material operations in the facilities or areas where radioactive material is/was used or stored and intended for decommissioning.

(b) Notify the NRSC, via NAVSEA DET RASO, that operations have stopped within 60 days of their cessation.

(c) Arrange to have all radioactive material removed from the areas or facilities to be terminated.

(d) Prepare a Historical Radiological Assessment (HRA) to determine the location and level of radioactive contamination remaining in the facility or area. This may require the use of a contractor. Contact NAVSEA DET RASO for assistance.

(e) If required, develop a decommissioning plan to remove residual radioactive contamination to levels prescribed by reference (e) Part 20.1402 or 20.1403. This may require the use of a contractor. The command should contact NAVSEA DET RASO for assistance in developing the plan.

(f) Provide environmental radioactivity information to demonstrate compliance with environmental Protection Agency (EPA) regulations.

(g) Receive NRSC approval, through a NRMP amendment, to begin decommissioning activities.

(h) Decontaminate appropriate locations as required.

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(i) Conduct a Final Status Survey to demonstrate compliance with Navy and NRC dose limits required for NRMP termination.

(j) Request that the NRSC terminate or amend the NRMP, as applicable.

**CHAPTER 10**  
**USNA RADIOLOGICAL DEFICIENCY REPORT (RDR) SYSTEM**

1. **Compliance Philosophy.** The operative compliance philosophy is to know the requirements and proactively meet them; find and effectively fix issues internally; and when outside inspectors reveal deficiencies, take ownership of them and fix them. Key tools in ensuring compliance are: effective surveys; internal audits; program, procedure, and standard operating procedure reviews; and surveillances. The program should identify single point failures and install an appropriate scheduling and administrative tickler system to prevent personnel oversights from causing an infraction. The program is expected to conduct thorough root cause analysis and develop effective corrective actions that will prevent recurrence of the same or similar events.

2. **Individual Responsibilities.** All individuals are expected to report any conditions or activities including but not limited to deficiencies, abnormal conditions and improvement items, which they feel may present a risk to human health or the environment, or which may not be in full compliance with Federal, Navy, or Local regulations. Reports should preferably be made electronically using a template available from the Radiation Safety Office, directly to the RSO or, commensurate with the perceived risk or severity of consequences to any member of the USNA RSC or chain of command, up to and including the Superintendent or members of the Superintendent's staff. Improvement items may also be entered as an RDRs to document them. An individual designated as RDR "supervisor" will ensure actions taken to correct the deficiencies and abnormal conditions are appropriate and documented.

3. **RSO Responsibilities.** The RSO must immediately initiate an investigation in response to any complaint or incident included but not limited to the report of the misuse of radioactive material, of an unanticipated radiation exposure or, of an activity which is not in full regulatory compliance. Any incident defined in reference (a) Section 2.23 or CH 11 Section 5 have additional and specific reporting requirements outside of the RDR program. The RSO or ARSO will review each RASP deficiency and associated corrective action.

4. **Submission Process.** An entry should be made by submitting an RDR electronically to the Radiation Safety Office. RDR's may be reported directly to RSO depending on severity and need for immediate response. An (A)RSO will ensure the entry is logged and reviewed in the RDR log. Each RDR is assigned a level of significance defined in reference (a) Section 2.11.1.5. The RDR entry will be forwarded and discussed with the Licensee and reviewed by the USNA RSC. RDR records will be maintained for 3 years. The log must include at least:

- a. The problem or deficiency.
- b. Date of discovery.
- c. Name and contact information for the person discovering the problem.
- d. Immediate corrective action(s) taken, apparent cause (for deficiencies, if known).
- e. Supervisory review and comment.

f. RSO or ARSO review and comment.

g. The documentation should also include a serial number comprised of the year and sequential number.

5. Levels of Significance. Each RDR will be assigned a level of significance. The severity levels that inform enforcement actions taken by the USNA RSC will be based on the reference (a) Section 2.11.1.5.

a. Incidents.

(1) **A1**: An actual loss of safety or security. It is associated with severe or potentially severe bodily harm to a person.

(2) **A2**: Reflects the result of a loss of safety or security, but to a lesser extent. It is associated with bodily harm or potential bodily harm to a person.

b. Potential incidents.

(1) **B1**: Exists when there is a realistic potential for the loss of safety or security. It may be associated with systemic failure to accomplish or meet a RASP regulatory requirement.

(2) **B2**: Has more than minor safety or environmental significance. It may be associated with non-systemic failures to accomplish or meet RASP regulatory requirements. If uncorrected, the problem could lead to an incident.

c. Deficiency and improvement items.

(1) **C1**: Deficiencies have minor safety, health, or environmental significance. These violations typically reflect inadequate documentation of program compliance requirements or minor problems that if left uncorrected could lead to a more significant issue.

(2) **C2**: Items identified as program improvements and do not impact RASP compliance.

6. USNA RSC Authority to Suspend Operations. The USNA RSC maintains the authority to suspend, modify, or revoke any license when the actions of the authorized user(s) present an unacceptable health risk to personal health or property, or jeopardizes the DoD's Navy or Federal radioactive material licenses.

7. Critique Requirements. Incidents and potential incidents require a casual analysis, formal critique and corrective actions identified in compliance with reference (a) Section 2.11.2.3. No actions of an administrative or disciplinary nature must be addressed during the critiques.

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8. Trend Analysis. The RSO/ARSO must perform a trend analysis as part of the semiannual audit per reference (a) Section 2.11.2.d. The (A)RSO will complete a quarterly RDR report to share with division leadership, Laboratory managers, and USNA RSC.

CHAPTER 11  
USNA REQUIREMENTS FOR OPERATING  
AND EMERGENCY PROCEDURES

1. General Requirements. Reference (a) Section 2.14 provides general and specific requirements for Operating and Emergency procedures.

a. The command will develop and maintain operating and emergency procedures for the safe use of radioactive material and radiation producing machines and devices.

b. Command operating and emergency procedures will be developed and written by the command's subject matter expert and authorized users of the radioactive material or radiation producing machines and devices.

c. The operating and emergency procedures must be reviewed and approved by the command RSO.

d. The operating and emergency procedures must be a command level instruction or part of a command endorsed RASP instruction. Specifically;

(1) Command level instruction (this instruction) outlines the requirements of operating and emergency procedures.

(2) The USNA RSC and Radiation Safety Office have established and annually review the USNA RASP Emergency Response Plan that outlines the responses to radiological incidents outlined in CH 11 Section 6.

(3) School endorsed standard operating procedures (SOP) establish the operating and emergency procedures for each radiological facility and machine source, as applicable.

e. Each revision to an operating and emergency procedure will be subject to the same approval process as the original.

f. As a condition of the NRMP, revisions or changes must be submitted as a NRMP amendment request per reference (a) Section 3.2.3.

g. Operating procedures must not be a reprint of the manufacturer's operating manual. They will incorporate the specific procedures and processes required by the command to safely use the device. The procedures must be adapted for the local installation and environment and conform to reference (a) and local guidance. Procedures vary greatly by machine; however, they must be reviewed and approved by the RSO and the USNA RSC.

2. Specific Requirements. As appropriate, operating and emergency procedures will: (reference (a) Section 2.14.2.1)

- a. Be specific to each RASP operation, each piece of equipment, and facility/location. Use of portable equipment at multiple temporary sites outside a permanent facility constitutes one location.
- b. Specify requirements for the use of primary and secondary dosimeters as required.
- c. Specify requirements for engineered controls and equipment.
- d. Specify contamination controls to be used when working with unsealed radioactive material.
- e. Specify requirements for radiation protection surveys necessary to ensure RASP operations are conducted safely to include any special instrumentation and airborne monitoring for radioactivity.
- f. Specify requirements for checking safety features such as lights, alarms, and interlocks.
- g. Specify the personal qualifications required to perform the operation, and if applicable, internal monitoring required when working with unsealed radioactive material.
- h. Specify and provide representative examples of all logs, records, and forms required to support each operation.
- i. Include or reference another document that has current and accurate information on persons to be notified in the event of a radiological incident, and specify the method of notification.
- j. Specify procedures to use in case of a radiological incident, including shutting down the affected equipment and securing the area.
- k. Specify that the RSO or ARSO must be able to respond to an on-site radiological incident within the time required for normal commuting (<2 hours) to the command for RASP operations to take place.

3. USNA Standard Operating Procedures. All ionizing radiation producing machines at USNA are required to have a standard operating procedure (SOP) that has been reviewed by the RSO and USNA RSC and endorsed by School Leadership. The SOP is written by subject-matter experts, e.g. individual Licensees, to encompass the information outlined above (CH 11 Sections 1 and 2). Radioactive materials that are listed on the NRMP may also have an SOP that outlines the use, handling, and storage of these materials. The safety evaluation completed by the USNA Radiation Safety Committee as part of the licensing program would determine the severity of radiological hazards, which would require the need for a USNA SOP. Radiological laboratories that only store and maintain exempt quantity radioactive material do not require a USNA SOP, but rather only an approved license by the USNA RSC.

SOPs are locally maintained by each instrument. SOPs are available via the School Website under instructions. SOPs are available by request from the RSO, USNA RSC, and Licensee.

4. USNA Operating and Emergency Procedures Requirements. Each Licensee will conspicuously post a copy of the USNA RASP Emergency Response procedures, which relate to activities authorized under their license and ensure that personnel working under their supervision are aware of the location of the posting. In addition, the Licensee must ensure that emergency telephone numbers are listed on the space provided on the posting.

5. Reporting Radiological Incidents to NAVSEA DET RASO. This section outlines the requirements of reference (a) Section 2.27 on the appropriate protocols for reporting radiological incidents.

a. Any radiological incidents listed in CH 11 Section 6 must be reported to NAVSEA DET RASO immediately.

b. Initial notification may be made via telephone.

c. Initial follow up reports must be completed within 10 days with updates to NAVSEA DET RASO. The written report must include the following information:

(1) A description of the operation; date; time; location; individual(s) involved; doses received; isotopes, quantities, chemical and physical form; manufacturer and model number of any equipment that failed or malfunctioned, etc.

(2) A description of the circumstances under which the accident or incident occurred.

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

(4) A determination of the cause(s), immediate actions taken, long-term corrective actions planned to prevent recurrence, and the plan of actions and milestones (POAM).

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

(6) Signature of the Commander, CO, or OIC.

6. List of Radiological Incidents. The following incidents all fall under reportable radiological incidents.

a. Fire, explosions and emergency related incidents.

(1) Any event that prevents immediate protective actions necessary to avoid exposures to radiation or radioactive materials that could exceed regulatory limits or releases of licensed material that could exceed regulatory limits (events may include fires, theft, explosion, toxic gas releases)

(2) An unplanned fire or explosion damaging any licensed material or any device, container, or equipment containing licensed material when the quantity of material involved is greater than five times the lowest annual limit on intake specified in reference (e) Part 20 Appendix B for the material and the damage affects the integrity of the licensed material or its container.

b. Exposure related incidents.

(1) External and/or internal radiation dose in excess of the limits of CH 4 Table 4-1.

(2) External and/or internal radiation dose in excess of the ACLs in CH 4 Table 4-1.

(3) Radiation dose to an individual member of the public to greater than 2 mrem (0.02mSv) in any one hour or 100 mrem (1 mSv) in a year.

(4) Report of planned special exposure.

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

(6) Entry into a high radiation area without the required dosimetry devices and 1 mrem or more of exposure is received.

c. Contamination, spill, discharge and disposal related incidents.

(1) The release (spills) of radioactive material, inside or outside of a restricted area, so that, had an individual been present for 24 hours, the individual could have received an intake five times the annual limit on intake.

(2) The release (spill) of radioactive material, inside or outside of a restricted area, so that, had an individual been present for 24 hours, the individual could have received an intake in excess of one occupational annual limit on intake.

(3) An unplanned contamination event that requires access to the contaminated area, by workers or the public, to be restricted for more than 24 hours by imposing additional radiological controls or by prohibiting entry into the area; involves a quantity of material greater than five times the lowest annual limit on intake specified in reference (e) Part 20 Appendix B for the material; and has access to the area restricted for a reason other than to allow isotopes with a half-life of less than 24 hours to decay prior to decontamination. Refer to reference (a) Sections 2.20.1 and 2.20.2 for guidance on contamination controls.

(4) Levels of radiation or concentrations of radioactive material in a restricted area in excess of any applicable limit in the NRMP; or an unrestricted area in excess of 10 times any applicable limit set forth in reference (e) Part 20.2203 or in the NRMP (whether or not involving exposure of any individual in excess of the limits in reference (e) Part 20.1301).

(5) Receipt of packages with contamination or radiation levels in excess of reference (e) Part 71 limits.

(6) Release of radioactive material into the environment above the effluent limits of reference (e) Part 20 Appendix B.

(7) Spills of radioactive material outside controlled areas.

(8) Unauthorized disposal of radioactive material.

d. Airborne related incidents: An individual member of the public receives a total effective dose equivalent in excess of 10 mrem (0.1 mSv) per year from air emissions of radioactive material to the environment.

e. Theft or loss of radioactive material or ionizing radiation producing machines incidents.

(1) Loss or theft or attempted theft or unauthorized production of special nuclear material.

(2) Theft or loss of licensed (including generally licensed) radioactive material or machines that produce ionizing radiation.

f. Leaking sealed radioactive source.

g. Equipment failure and misuse incidents (reference (a) Section 2.23.1.2.h.(3)).

(1) An event in which equipment is disabled or fails to function as designed when the equipment is required by regulation or NRMP condition to prevent releases exceeding regulatory limits, to prevent exposures to radiation and radioactive materials exceeding regulatory limits, or to mitigate the consequences of an accident; the equipment is required to be available and operable when it is disabled or fails to function; and no redundant equipment is available and operable to perform the required safety function.

(2) All defects, deviations and non-compliance (failure to comply) with any applicable NRC regulation or order which could create a substantial safety hazard of an ongoing or recurring nature.

(3) Failure of safety devices to function properly such as an interlock not terminating exposure.

## 7. General Rules of Safety.

a. Each individual who handles radioactive material is responsible for minimizing the radiation exposure to themselves and other individuals within the work area, and to take appropriate steps to prevent personal contamination and contamination of the environment. To

satisfy this requirement, each Licensee and authorized user must ensure that, as a minimum, the following rules are observed in rooms or areas where unsealed sources of radioactive material are handled:

- (1) Eating and drinking, or the presence of food or beverages, is forbidden.
  - (2) The presence of reusable cups or eating implements in open laboratory areas is forbidden.
  - (3) Smoking, or the presence of tobacco products and smoking paraphernalia, is forbidden.
  - (4) Pipetting by mouth is forbidden.
  - (5) Radioactive materials must not be handled by individuals with exposed cuts or abrasions.
  - (6) No individual will handle unsealed radioactivity unless they are wearing protective gloves and a lab coat. Protective gloves and lab coats must be removed immediately when contamination is suspected.
  - (7) Handling of radioactive material must be limited to the smallest area possible. To the extent practical, radioactive work areas will be delineated using warning tape or warning signs. Each worker is responsible for informing others in the laboratory of the locations where they are using radioactive material.
  - (8) All items such as glassware, pipettes, forceps, pens etc., used during procedures involving unsealed radioactivity must be labeled with radioactive material warning tape.
  - (9) All surfaces on which work with unsealed radioactivity is conducted will be covered with waterproof backed absorbent paper. This covering must be changed when contaminated. Work involving large volumes of radioactive liquid must be carried out in a splash tray capable of containing the volume being handled.
  - (10) Vials containing sources of penetrating radiation will be maintained in a suitable shield to the extent practical.
  - (11) Radioactive liquids and powders will be carried in their containers within a second non-breakable container
  - (12) Unshielded sources of radioactivity must only be handled using forceps or other devices to maintain an adequate distance from the fingers.
- b. When personal or area contamination is suspected, work with unsealed radioactivity must be stopped as soon as possible so that decontamination procedures may be undertaken.

8. Responses to Radiological Incidents. See Appendix E that shows an example of the USNA RASP Emergency Plan.

Appendix A  
DEFINITIONS

**Absorbed Dose** - The energy imparted to matter by ionizing radiation per unit mass of irradiated material at the place of interest. The unit of absorbed dose are the rad and the gray (Gy). One Gy equals 100 rad.

**Accelerator Expert (Qualified Expert)** - An individual who has the appropriate combination of education and work experience to make sound judgments regarding specific areas of work to which he or she has been assigned. Minimum qualifications should include a Bachelor of Science (BS) in a science or engineering field and 3 years of relevant work experience at accelerator facilities. A higher degree of education can substitute for some working experience. For example, an individual authorized to design and/or certify interlocked access control systems must have education, experience, and training that is commensurate with the tasks assigned. In addition, the individual authorized to design and/or certify the radiation shielding design must have the knowledge and training to undertake an analysis and design of a radiation-shielding system. A radiation safety professional is a qualified expert in the areas of radiation safety.

**Airborne Radioactive Material** - Any radioactive material dispersed in air in the form of dusts, fumes, particles, mists, vapors, or gases.

**Airborne Radioactivity Area** - A room, enclosure, or area in which airborne radioactive materials, composed wholly or partly of licensed material, exist in concentrations: In excess of 10 percent of the DACs specified in Appendix B, to 10 CFR 20, or to such a degree that an individual present in the area without respiratory protective equipment could exceed, during the hours an individual is present in a week, an intake of 0.6 percent of the ALI or 12 DAC-hours.

**ALARA** - Acronym for "As Low As is Reasonably Achievable" means making every reasonable effort to maintain exposures to radiation as far below the dose limits stated in Table 1 as is practical and consistent with the command's mission, taking into account the state of technology, the economics of improvements in relation to state of technology, the economics of improvements in relation to benefits to the public health and safety, and other societal and socioeconomic considerations, and in relation to the Department of Defense's mission in service to the public interest of national security.

**Annual Limit on Intake** - The derived limit for the amount of radioactive material taken into the body of an adult worker by inhalation or ingestion in a year. ALI is the smaller value of intake of a given radionuclide in a year that would result in a committed effective dose equivalent of 5 rem (0.05 Sv) or a committed dose equivalent of 50 rem (0.5 Sv) to any individual organ or tissue.

**Annually** - Perform once per calendar year.

**Authorized User** - Individuals who have access to Radioactive material specified on the USNA Naval Radioactive Material Permit (NRMP) or machine sources capable of exposing individuals with >100 mrem/yr or 2 mrem/hr exposure. Such sources shall only be used by the USNA

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Licensee and those individuals under his/her supervision who are designated as Authorized Users. Authorized Users may or may not be Radiation Workers depending on the hazard associated with their activity. Authorized users must be approved by the RSO/RSC.

**Becquerel (Bq)** - A unit of radioactivity equal to one disintegration per second.

**Byproduct Material** - Any radioactive material (except special nuclear material) yielded in, or made radioactive by, exposure to the radiation incident to the process of producing or using special nuclear material; the tailings or wastes produced by the extraction or concentration of uranium or thorium from ore processed primarily for its source material content, including discrete surface wastes resulting from uranium solution extraction processes. Underground ore bodies depleted by these solution extraction operations do not constitute "byproduct material" within this definition; any discrete source of radium-226 that is produced, extracted, or converted after extraction, before, on, or after August 8, 2005, for use for a commercial, medical, or research activity; or any material that has been made radioactive by use of a particle accelerator and is produced, extracted, or converted after extraction, before, on, or after August 8, 2005, for use for a commercial, medical, or research activity; any discrete source of naturally occurring radioactive material, other than source material, that;

a. The Commission, in consultation with the Administrator of the Environmental Protection Agency, the Secretary of Energy, the Secretary of Homeland Security, and the head of any other appropriate Federal agency, determines would pose a threat similar to the threat posed by a discrete source of radium-226 to the public health and safety or the common defense and security; and

b. Before, on, or after August 8, 2005, is extracted or converted after extraction for use in a commercial, medical, or research activity.

**Calibration** - Adjustment or determination of the response or reading of an instrument relative to a series of conventionally true values; or determination of the activity of the activity of a radiation source relative to a standard or conventionally true value.

**Command** - Any Navy or Marine Corps base, facility or activity.

**Committed Dose Equivalent** - The dose equivalent to an organ or tissue that will be received from an intake of radioactive material by an individual during the 50-year period following the intake.

**Committed Effective Dose Equivalent** - The sum of the products of the weighting factors applicable to each of the body organs or tissues that are irradiated and the committed dose equivalent to these organs or tissues.

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

**Contamination Worker** - Contamination workers are personnel who receive exposure to ionizing radiation in the course of their employment or duties, and are identified by their

command as being occupationally exposed. Normally, these individuals' routine duties require working directly with unsealed radioactive material and have a potential to become contaminated. NAVMED P-5055 should be consulted to determine whether these individuals are required to receive radiation medical examinations. These individuals also normally receive specialized training as part of a specific radiological controls program. USNA qualifies radiation workers also as contamination workers. Additional training and experience shall be provided under RSO/ARSO's discretion.

**Controlled Area** - Controlled area means an area, outside of a restricted area but inside the site boundary, access to which can be limited by the licensee for any reason.

**Curie** - A unit of radioactivity equal to  $3.7 \times 10^{10}$  disintegrations per second or  $3.7 \times 10^{10}$  becquerels or  $2.22 \times 10^{12}$  disintegrations per minute.

**Custodian** - The term custodian shall apply to any USNA faculty/staff maintaining authority over quantities of NRC licensed material/machine sources or exempt quantity sources. The custodian may also be considered an authorized user and/or radiation worker. The custodian for licensed material can also be considered the USNA Licensee (refereed in application as: principle user or facility managers). Custodians will be responsible for the reference (a) regulatory compliance of their respective sources of ionizing radiation. All non-compliance issues will be addressed directly by the Custodian of the source.

**Derived Air Concentration Hour (DAC-Hr)** - The product of the concentration of radioactive material in air (expressed as a fraction or multiple of the derived air concentration for each radionuclide) and the time of exposure to that radionuclide, in hours. A licensee may take 2,000 DAC-hours to represent one ALI, equivalent to a committed effective dose equivalent of 5 rem (0.05 Sv)

**Direct Supervision** - Being in the physical presence and having visual sight (direct observation) of the individual being supervised.

**Dose** - A generic term that means absorbed dose, dose equivalent, effective dose equivalent, committed dose equivalent, committed effective dose equivalent, or total effective dose equivalent (TEDE).

**Dose Equivalent** - The product of the absorbed dose in tissue, quality factor, and all other necessary modifying factors at the location of interest. The units of dose equivalent are the rem and Sievert (Sv).

**Dosimetry (Primary and Secondary)** - Individual monitoring equipment designed to be worn or carried by an individual for the purpose of detecting and measuring an individual's exposure to ionizing radiation.

**Effective Dose Equivalent** - The sum of the products of the dose equivalent to the organ or tissue and the weighting factors applicable to each of the body organs or tissues that are irradiated.

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**Exempt quantity** - Radioactive byproduct material in individual quantities, each of which does not exceed the applicable quantity set forth in 10 CFR 30.71, Schedule B. These radioactive materials are free of NRC restrictions due to their low safety risk. However, all exempt quantity sources must be inventoried and custodians must maintain positive custody once on USNA premises.

**Exposure** - The process of being exposed to ionizing radiation or radioactive material.

**Facility** - The location at which one or more devices or sources of ionizing radiation are installed or located within one building, vehicle, or under one roof and are under the same administrative control.

**General Public** - Individuals who are not occupationally exposed to ionizing radiation shall be considered members of the general public. Examples would include individuals that live and work outside the perimeter of a command, family members of an employee, or crew members that live on a base but are outside a controlled industrial area, and visitors that do not normally receive occupational exposure.

**Gray (Gy)** - The SI unit of absorbed dose. One gray is equal to an absorbed dose of 1 Joule/kilogram (100 rads).

**High Radiation Area** - Any area, accessible to individuals, in which radiation levels from radiation sources external to the body could result in an individual receiving a dose equivalent in excess of 0.1 rem (1.0 mSv) per hour at 30 cm (approximately 1 foot) from the radiation source or 30 centimeters from any surface the radiation penetrates.

**Immediate Notification** - In reference to contacting NAVSEA DET RASO, the RSO or ARSO shall make positive contact with someone at NAVSEA DET RASO (757-887-4692) as soon as possible after it becomes known to the command of an incident that requires immediate notification.

**Interlock** - A device or device group arranged to sense a limit, an off-limit condition or improper event sequence that functions to shut down the equipment or prevent its operation. Interlocks are specifically designed to avoid and/or terminate a hazardous radiation condition.

**Internal Audit** - A documented examination by responsible management individual (i.e., RSO, ARSO, Senior Radiographer, supervisor, foreman, etc.) of the RASP or any element thereof (training, posting, operations, procedures, records, etc.) to verify compliance with requirements and established procedures.

**Ionization** - The process of adding one or more electrons to, or removing one or more electrons from, atoms or molecules, thereby creating ions. High temperatures, electrical discharges, or nuclear radiations can cause ionization.

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**Ionizing Radiation** - Any electromagnetic or particulate radiation capable of producing ions, directly or indirectly, in its passage through matter. Ionizing radiation includes the following: gamma rays, X-rays, alpha particles, beta particles, neutrons, protons, and other particles and electromagnetic waves capable of producing ions.

**Ionizing Radiation Sources** - Any machine or radioactive material source capable of producing ionizing radiation.

**Initial Facility Evaluation** - An evaluation of an X-ray radiography facility to determine its classification as an exempt shielded, shielded, or open facility prior to placing a facility into routine operation. A radiation protection survey will provide the basis for the facility evaluation. Facility evaluations will be conducted by NAVSEA DET RASO using data provided by a radiation protection survey performed by the local RSO/ARSO.

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

**Licensed Radioactive Material** - Source Material, special nuclear material, or byproduct material that is received, possessed, used or transferred under a general or specific license issued by the Nuclear Regulatory Commission.

**Licensed Quantity** - Radioactive byproduct material in excess of individual quantities set forth in 10 CFR 30.71, Schedule B. These quantities of radioactive material are a safety risk to the public, and therefore require comprehensive safety precautions. Possession of licensed quantities are maintained by USNA licensees and overseen by the RSC.

**Machine Source** - Electrically operated sources of ionizing radiation (as described in reference (a)). Machine sources contain no radioactive material, and can be disabled by removing the power source when not in operation.

**Naval Radioactive Materials Permit (NRMP)** - Authorization issued by the Naval RSC to a command to receive, possess, use, store, transfer or dispose of radioactive material as specified in reference (a) Section 3.

**Non-Radiation Worker** - Workers who receive very low-level radiation exposure incidental to their employment at a command but not as an integral part of their skill, trade or work assignment. Their assigned duties do not involve the direct use of RASP sources of ionizing radiation and they are not authorized to receive, in a year, a dose of radiation greater than 500 mrem (5 mSv) from RASP sources. These individuals may regularly access areas near or adjacent to RASP sources and may periodically be in radiation areas. Examples include: supervisors, management personnel, safety inspectors, radiation health personnel, gas chromatograph operators, maintenance personnel, delivery personnel, messengers, security personnel, firefighters, medical personnel, emergency response personnel and inspectors.

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

**Occupancy Factor** - The factor ( $\leq 1$ ) for the degree of occupancy (by any one person) of the area in question while the radiation source is emitting radiation.

**Principal Activity** - Activities authorized by the NRMP which are essential to achieving the purpose(s) for which the NRMP was issued or amended. Storage during which no licensed material is accessed for use or disposal and activities incidental to decontamination or decommissioning are not principal activities.

**Public** - USNA faculty, staff, students, visitors who are expected to receive less than 2 mrem/hr or 100 mrem/yr of radiation exposure.

**Qualified Expert** - An individual who has the appropriate combination of education and work experience to make sound judgments regarding specific areas of work to which he or she has been assigned. Minimum qualifications should include a Bachelor of Science (BS) degree in a science or engineering field and three years relevant work experience at accelerator facilities. A higher degree of education can substitute for some working experience. For example, an individual authorized to design and/or certify an interlocked access control system shall have education, experience and training that is commensurate with the tasks assigned. In addition, the individual authorized to design and/or certify the radiation shielding design must have the knowledge and training to undertake an analysis and design of a radiation-shielding system. A Radiation Safety Professional is a qualified expert in the areas of radiation safety.

**Quarter (Calendar)** - A period of time equal to one-fourth of the year (approximately 13 consecutive weeks), providing that the beginning of the first quarter in a year coincides with the starting date of the year and that no day is omitted or duplicated in consecutive quarters.

**Quarterly** - Perform once in each quarter within a calendar year.

**Quality Assurance Program** - A program for the systematic monitoring and evaluation of the various aspects of a project, service, operation, or facility to ensure that standards of quality are being met.

**Quality Factor** - The factor by which the absorbed dose (rad or gray) is to be multiplied to obtain a quantity that expresses, on a common scale for all ionizing radiation, the biological damage (rem or sievert) to an exposed individual. It is used because some types of radiation, such as alpha particles, are more biologically damaging internally than other types.

**Quick Scan Radiation Survey** - A radiation survey conducted by moving a radiation survey instrument over a specific area anticipated to be the most likely source of leakage at a slow enough movement rate to allow adequate response and noting the highest reading observed.

**Rad** - The special unit of absorbed dose. One rad is equal to an absorbed dose of 100 ergs/gram or 0.01 joule/kilogram (0.01 gray). Units of Radiation Dose — Note: For X-ray and gamma ray

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fields, 1 roentgen (R) is approximately numerically equal to 1 rad, which is also approximately numerically equal to 1 rem.

**Radiation Area** - An area, accessible to individuals, in which radiation levels exceed 2 mrem/hr (0.02 mSv/hr) at 30 centimeters from the radiation source or from any surface that the radiation penetrates. For the purposes of the RASP, a restricted area, as defined in 10 CFR 20, is considered a radiation area and will meet the definition of a radiation area.

**Radiation Producing Machine** - Any device or equipment capable of generating ionizing radiation directly or indirectly.

**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.

**RSO** - A qualified individual, appointed by the Commander, Commanding Officer, or Officer in Charge who is responsible for the safe conduct and assurance of adequate radiation protection from the use of radioactive material and radiation generating equipment associated with the RASP and in accordance with reference (a).

**Radiation Worker** - Radiation workers are individuals who receive exposure to ionizing radiation in the course of their employment or duties and are identified by their command as being occupationally exposed. Normally, these individuals' routine duties require working directly with sources of ionizing radiation and have a significant potential for exposure. Reference (b) should be consulted to determine whether these individuals are required to receive radiation medical examinations. These individuals normally receive specialized training as part of a specific RASP.

**Radioactive Contamination Area** - Any area, accessible to individuals, where surface contamination levels exceed, or are likely to exceed, the surface contamination values specified in reference (a) Table 2-2.

**Radioactive Material (RAM)** - Any material or combination of materials, which spontaneously emit ionizing radiation.

**Radioactive Waste** - Any radioactive material that meets all of the following conditions: (1) material no longer needed or usable; (2) material that cannot be returned to the manufacturer; (3) material requires controlled disposal; and (4) material has been declared to be waste by an inventory control point.

**Radiographic Exposure Device** - Any instrument containing a sealed source fastened or contained therein, in which the sealed source or shielding thereof, may be moved or otherwise changed from a shielded to unshielded position for purposes of making a radiographic exposure.

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**Radiographer** - Any individual who performs radiography or who in attendance at the site, personally supervises industrial radiographic operations, and who is responsible to the Commander, Commanding Officer, or Officer in Charge for assuring compliance with the requirements of reference (a) and conditions of applicable Naval Radioactive Materials Permit.

**Radiographer's Assistant** - Any individual who under the direct supervision of a radiographer, uses radiographic exposure devices, sealed sources or related handling tools, or radiation survey instruments in industrial radiography.

**Radiographic Operations** - All activities associated with the presence of radioactive sources in a radiographic exposure device during use of the device or transport (except when being transported by a common or contract transport), to include surveys to confirm the adequacy of boundaries, setting up equipment and any activity inside radiation area boundaries.

**Radiography** - The examination of the structure of material by nondestructive methods utilizing sealed sources of radioactive material or radiation producing machines.

**Radiation Safety Officer (RSO)** - The RSO is designated by USNA Superintendent and is responsible for the operation of the radiation affairs safety program (RASP) including maintaining regulatory compliance. The RSO is responsible for recommending or approving corrective actions, identifying radiation safety problems, initiating action, and ensuring compliance with regulations. The RSO is also responsible for assisting the Radiation Safety Committee in the performance of their duties.

**Radiation Workers** - Individuals who receive exposure to ionizing radiation in the course of their employment or duties and are identified as potentially able to receive an annual dose in excess of 100 mrem or be exposed at a rate greater than 2 mrem/hr. Normally, these individuals' routine duties require working directly with sources of ionizing radiation and have a significant potential for exposure. These individuals are required to receive radiation medical qualifications provided by the Naval Health Clinic. These individuals receive specialized training as part of a specific RASP.

**Radiation Safety Committee (RSC)** - The USNA Radiation safety program is directed by the Radiation Safety Committee (RSC). Membership of the RSC includes Authorized Users of the major types of use of radioactive material and ionizing radiation-generating devices (machine sources), along with a representative from USNA management. The RSC meets quarterly to discuss: current and future radiological safety standards approve new USNA Licensee's, Authorized users, custodians, audit findings, radiological compliance, deficiencies, and day to day radiological safety program operations.

**Radiological Accident or Emergency** - Loss of control of radiation producing machines or radioactive material which presents a hazard to life, health or property, or which may result in any member of the general population exceeding dose limits for ionizing radiation.

**Response** - Activities that address the short-term, direct effects of an incident. Response includes immediate actions to save lives, protect property, and meet basic human needs. Response also

includes the execution of emergency operations plans and of mitigation activities designed to limit the loss of life, personal injury, property damage, and other unfavorable outcomes.

**Rem** - The special unit of any of the quantities expressed as dose equivalent. The dose equivalent in rem is equal to the absorbed dose in rads multiplied by the quality factor (1 rem = 0.01 sievert).

**Roentgen (R)** - A unit of X-ray or gamma exposure determined by measuring the ionization produced in air by x or gamma radiation of energies less than or equal to 3 MeV. It is the sum of the electrical charges of all of the ions of one sign produced in air when all electrons liberated by photons in a volume element of air are completely stopped in the air, divided by the mass of the air in the volume element. One roentgen produces  $2.58 \times 10^{-4}$  coulombs/kilogram of air.

**Semiannually** - Perform once in the first six months of the calendar year and once in the second six months of the calendar year.

**Sievert (Sv)** - The SI unit of any of the quantities expressed as dose equivalent. The dose equivalent in sieverts is equal to the absorbed dose in grays multiplied by the quality factor (1 Sv = 100 rems).

**Sealed Source** - Any byproduct material that is encased in a capsule designed to prevent leakage or escape of the byproduct material.

**Source Material** - Source material means: (1) Uranium or thorium, or any combination thereof, in any physical or chemical form or (2) ores which contain by weight one-twentieth of one percent (0.05 percent) or more of: (i) Uranium, (ii) thorium or (iii) any combination thereof. Source material does not include special nuclear material.

**Special Nuclear Material** - Special nuclear material means: (1) Plutonium, uranium 233, uranium enriched in the isotope 233 or in the isotope 235, and any other material, which the Commission, pursuant to the provisions of section 51 of the Atomic Energy Act, determines to be special nuclear material; or (2) any material artificially enriched by any of the foregoing.

**Surveillance** - The observation of a person or group for the purpose of assessing the operational performance of the individual or group.

**Survey** - An evaluation of the radiological conditions and potential hazards incident to the production, use, transfer, release, disposal, or presence of radioactive material or other sources of radiation (machine sources). When appropriate, such an evaluation includes a physical survey of the location of radioactive material/machine source and measurements or calculations of levels of radiation, or concentrations or quantities of radioactive material present. An official radiological safety audit can be performed by the RSO/ARSO/ or any USNA party qualified by the RSO in performing a safety survey.

**Total Effective Dose Equivalent (TEDE)** - The sum of the effective dose equivalent (for external exposures) and the committed effective dose equivalent (for internal exposures).

**Type "A" Package** - A package designed to retain the integrity of containment and shielding required by reference (g) under normal conditions of transport as demonstrated by the tests set forth in reference (g) Part 173.465 or 173.466, as appropriate.

**Type "B" Package** - A package designed to retain the integrity of containment and shielding required by 49 CFR when subjected to the normal conditions of transport and hypothetical accident test conditions set forth in reference (e) Part 71.

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

**USNA Licensee** - USNA Licensees are faculty and staff who have submitted a radiation use license application and have been approved as a licensee by the USNA RSC. USNA Licensees are considered the custodian and the principle user or lab/facility manager. Licensees may request additional Authorized Users to operate under their USNA RSC approved license. The Licensee will only be permitted to operate under the conditions of standard operating procedures approved by the USNA RSC. Any modifications of operations require RSO or USNA RSC approval prior to commencement. All non-compliance issues will be addressed directly by the Licensee or custodian of the source.

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Appendix B  
RASP PERIODICITY

**Table B-1 – RASP Periodicity Interpretations**

| <b>Periodicity</b>      | <b>Meaning</b>                           | <b>Example</b>                                                                                                                                                                              |
|-------------------------|------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Every 5 years           | To complete by the MM/DD 5 years later   | A USNA Local Authorization was signed by RSC Chair on <b>4 JAN 2023</b> . The next review and update must be completed by <b>4 JAN 2028</b> .                                               |
| Annually                | Any time during the year                 | The Annual Emergency drill was completed <b>20 DEC 2023</b> . The next Annual Emergency drill is due by <b>31 DEC 2024</b> .                                                                |
| Not to exceed 12 months | To complete by the MM/DD 12 months later | The radiation survey for chemistry radioactive materials was completed on <b>12 SEP 2023</b> . The next radiation survey for chemistry radioactive materials is due by <b>12 SEP 2024</b> . |
| Semiannually            | Any time within 6 months                 | The Machine Inventory was completed <b>24 OCT 2023</b> . The next Machine Inventory should be completed by <b>30 JUNE 2024</b> .                                                            |
| Not to exceed 6 months  | To complete by the MM/DD 6 months later  | Leak test was completed <b>16 NOV 2023</b> . The next leak test must be completed by <b>16 APR 2024</b> .                                                                                   |
| Quarterly               | To complete once in a quarter            | RSC audit was completed for Q1 on <b>2 JAN 2024</b> . The audit for Q2 is due by <b>30 JUN 2024</b> .                                                                                       |
| Not to exceed 3 months  | To complete by the MM/DD 3 months later  | A Nuke Lab radiation survey was completed on <b>20 DEC 2023</b> . The next radiation survey is due by <b>20 MAR 2024</b> .                                                                  |
| Monthly                 | To complete any time during the month    | The RSO RDR audit was completed on <b>16 JAN 2024</b> . The next RSO RDR audit is due by <b>29 FEB 2024</b> .                                                                               |
| MM = month<br>DD = day  |                                          |                                                                                                                                                                                             |

Appendix C  
LEAK TEST PROTOCOL (Example)

1. **Overview. Leak Tests** must be performed for all licensed permit radioactive materials as defined by NRMP or SSDR information for each individual source. Current requirements state that **leak tests** must be performed every NTE 6 months. The following protocol is focused on the step-by-step process of performing swipes, calibrating the G-520 instrument, and performing the analysis of the leak tests. This protocol is a general guide and should be adapted as needed. A **Leak test** will be performed with two individuals. One individual will be the primarily be responsible for the swipes of all required items and areas. The second individual will be responsible for access control, contamination control, contamination response if needed, and security.

2. **Instrument Set-up.** The instrument used for leak tests is the Gamma Products, G-520 Alpha/Beta Counting System located in RI-05.

- a. Turn on the computer for the instrument and login to the desktop.
- b. Open the G-520 program on the desktop.
- c. Turn on the G-520 instrument using the green switch on the front of the instrument.
- d. Carefully, open the valve on the compressed gas tank located to the left of the instrument.
- e. Adjust the regulator to 10 – 15 PSI.
- f. On the front of the G-520, adjust the air flow to 0.2 standard cubic feet per hour (SCFH). At this point, no lights on the front of the instrument should be red.
- g. Go to calibration and click high voltage plateau.
- h. Fill in the information as shown in table C-1.

**Table C-1 - High voltage plateau settings for calibration.**

| High Voltage Plateau |                  |                   |              |
|----------------------|------------------|-------------------|--------------|
| Sample to Count      | 1                | Starting Voltage: | 1500         |
| Plot Mode            | Gross/Alpha/Beta | Ending Voltage:   | 1800         |
|                      |                  | Voltage Step:     | 25           |
|                      |                  | Count Time:       | 5 min 00 sec |

| Source        |       | Options |              |
|---------------|-------|---------|--------------|
| Certification | None  | x       | Print report |
| Isotope       |       | x       | Print graph  |
| Emission Type | Mixed |         |              |

i. Pull out the sample window and using tweezers place the **standard** in the holder. (Note: the aluminum cover side should be face up)

j. Close the sample window.

k. Click Start.

l. Upon completion, the results and graph should automatically print.

3. Leak Test Sample Set-up. To prepare for the number of samples that should be tested, the following outlines best practices. On the table located next to the instrument:

a. Place an adsorbent pad as a secondary barrier where the leak test samples will be placed until the measurement is taken.

b. Take the appropriate number of swipe papers and label each one with the area or radioactive material that will be “swiped” for the leak test.

c. Take a AN/PDQ-4 RADIAC and place the probe end on the side next to the adsorbent pad. This will be used to monitor contamination throughout the leak tests.

(1) Make sure that the RADIAC has been response checked and logged.

(2) Do not forget to log the radiation check source in the source utilization log.

4. Performing Leak Test Swipes. All leak tests swipes are completed in a similar matter with a few exceptions. They will be listed in the protocol where appropriate. The swipes should be completed on the areas where leaking is most likely to be identified. Ensure that for alpha sources that the swipe is not completed on the source but adjacent surface near the source.

a. Before performing the leak test swipes:

(1) Acquire all keys that will be needed to gain access to any radioactive materials that should be leak tested.

(2) Open all necessary doorways to minimize unwanted contamination.

(3) Put on all appropriate PPE.

b. When performing the leak test swipe:

(1) Take the labeled swipe paper and make an “S” like figure in the area of interest that is approximately 100 cm<sup>2</sup>.

(2) Fold the swipe paper along the perforated edges containing the swipe to the center of the fold.

(3) Return to the sample area and hold the swipe near the RADIAC to determine if any contamination has occurred.

(4) Place the swipe on the adsorbent pad.

(5) Place your gloved hands in front of the RADIAC taking care to move slowly to determine if any contamination has occurred.

(6) Continue performing all necessary swipes repeating step 1 – 5 for all swipes.

c. Exceptions. A few items exist outside the immediate radioactive material storage cage in RI-75A. For those items, best practice is to prepare a secondary bag with the appropriate label to store the swipe and transport back to the instrument.

d. Concerns. If a count greater than 100 cpm over background is measured at any time during the leak test, contact the RSO immediately.

5. Leak test measurements.

a. On the program, click edit.

b. Highlight sample info.

c. From the dropdown menu, click **leak checks** under sample information name. The table should autofill. An Example of the table is shown in table C-2.

**Table C-2 - Enter/Edit Sample Information.**

| Enter/Edit Sample Information |           |             |             |       |          |         |         |
|-------------------------------|-----------|-------------|-------------|-------|----------|---------|---------|
| Sample Information Name       |           |             | Leak Checks |       | Grouping | Default |         |
|                               |           |             |             |       |          |         |         |
| Sample                        | Sample ID | Sample Type | Status      | Batch | Weight   | Volume  | Comment |
| 1                             |           | SWIPE       |             |       |          |         |         |
| 2                             |           |             |             |       |          |         |         |
| 3                             |           |             |             |       |          |         |         |
| 4                             |           |             |             |       |          |         |         |
| 5                             |           |             |             |       |          |         |         |
| Count Sequence                |           |             |             |       |          |         |         |

- d. If sample type does not say SWIPE, adjust each dropdown menu.
- e. If only running a few samples, enter the count sequence in the bottom box.
- f. Click start count.
- g. The next window, "Sample Count Information", will open and small pop up window will say "Load sample 1".
- h. Pull out the sample window and place the appropriate swipe into the sample holder using tweezers.
- i. Close the sample window.
- j. Click start.
- k. When the measurement is complete, the small window will reappear and state the next sample to be loaded.
- i. Repeat step 6 – 8 until all samples have been completed.
- j. At the completion of all measurements, a report will be generated and auto print.
- k. Clean up sample area. Once all leak test samples have been measured AND all frisking measurements showed no contamination, take the adsorbent pad and dispose of all swipes in the trash can. Return the standard to the storage area. Return the RADIAC to the storage area.

1. Shut down instrument. Close out of the program. Turn off computer. Shut the gas valve to the main tank and let the gas leak from the line. Once all gas has been removed from the line, close the regulator and flow valve. Turn off the instrument.

6. Leak test analysis. The leak test analysis is completed using a template provided by the Radiation Safety Office. A summary of the calculations will be discussed in Appendix C Section 7.

a. Using the leak test template, you will need to fill in all areas that are shaded in gray. This includes:

- (1) Date of counting.
- (2) Date of calibration.
- (3) Alpha counts for all measured swipes.
- (4) Beta counts for all measured swipes.

b. The sheet will calculate the minimal detectable activity (MDA) based on the counts inputted and show either a green or red result. **Green implies that no contamination is present.** The **standard** may produce results that are highlighted red. This is acceptable as the standard.

c. Upon completion of the sheet, print out:

- (1) Leak tests results (sheet 2)
- (2) Inventory list (sheet 3)

d. Complete a leak tests cover page that is linked on sheet 1. Fill in the cover page as appropriate and print to accompany all leak test data. Overall the leak check packet should include:

- (1) Cover page – completed and signed
- (2) Leak test results – completed, signed, reviewed
- (3) Inventory list
- (4) Instrument results – Standard two analysis report
- (5) Instrument calibration results – high voltage plateau and graph

7. General Calculations. If a leak test results in a measurement greater than 0.005  $\mu\text{Ci}$ , contact the RSO immediately (reference (a) Section 2.19.3.1).

- a. Determine Instrument Efficiency (based on counts from the standard).

$$\text{activity of standard } (\mu\text{Ci}) \times 37000 \frac{\text{dis}}{\text{sec } \mu\text{Ci}} = \text{standard } \frac{\text{dis}}{\text{sec}} \quad (1)$$

$$\frac{(\text{gross counts})}{(\text{standard } \frac{\text{dis}}{\text{sec}})(\text{analysis time min})(60 \frac{\text{s}}{\text{min}})} = \text{efficiency} \quad (2)$$

- b. Determine the minimum detectable counts (MDC).

$$\frac{2.72}{\text{time, min}} + 3.3 \sqrt{\frac{\text{Total background counts}}{\text{analysis time, min}} + \frac{\text{Total background counts}}{\text{analysis time, min}}} = \text{MDC } (\frac{\text{dis}}{\text{min}}) \quad (3)$$

- c. Determine the minimum detectable activity (MDA).

$$\frac{\text{minimum detectable counts}}{(2.22 \times 10^6 \frac{\text{dpm}}{\mu\text{Ci}})(\text{efficiency})} = \text{MDA } (\mu\text{Ci}) \quad (4)$$

- d. Gross counts to Activity ( $\mu\text{Ci}$ ).

$$\frac{(\text{total gross counts} - \text{total background counts})}{(37000 \frac{\text{dis}}{\text{sec } \mu\text{Ci}})(\text{efficiency})(60 \frac{\text{sec}}{\text{min}})(5 \text{ min})} = \text{sample activity } (\mu\text{Ci}) \quad (5)$$

- e. Activity ( $\mu\text{Ci}$ ) to Activity (Bq).

$$(\text{sample activity } \mu\text{Ci}) \left( 37000 \frac{\text{Bq}}{\mu\text{Ci}} \right) = \text{sample activity (Bq)} \quad (6)$$

## 8. Emergency Procedures:

- a. Frisk check of swipe with AN/PDQ-4 results in a reading 100 cpm greater than background.

(1) The secondary individual will immediately report to the Radiation Safety Office.

(2) The swipe should be placed on the adsorbent pad, secondary barrier, separate from all other swipes.

(3) The individual who performed the swipe should immediately check if contamination is also detected on the gloves.

(4) Follow the guidance of the (A)RSO.

b. Frisk check of gloves with AN/PDQ-4 results in a reading 100 cpm greater than background.

(1) The secondary individual will immediately report to the Radiation Safety Office.

(2) The individual with the contaminated gloves should carefully remove the gloves and place on the adsorbent pad.

(3) Re-frisk your hands to confirm that contamination has not spread to the hands. If the result confirms contamination, wash the hands thoroughly.

(4) Re-frisk your hands to determine if contamination remains.

(5) If the result confirms contamination, ask secondary individual to perform a thorough frisk of the arms of the individual.

(6) Follow the guidance of the (A)RSO.

c. Security: Loss or Theft

(1) If it is a known theft, contact the RSO, Security, and inform the chain of command immediately.

(2) Secure the area and stand guard until the RSO or security arrives.

(3) For instances of loss, secure the area and inform the Lab Manager and RSO.

(4) Search the area, check applicable source utilization logs, and review security footage if applicable.

(5) Conduct a full inventory of sources to ensure additional sources were not lost or stolen.

(6) Inform the chain of command and NAVSEA DET RASO of any lost or stolen sources.

APPENDIX D  
EXAMPLE RADIATION PROTECTION AUDIT

| Radiation Protection Audit  |  |                        |  |
|-----------------------------|--|------------------------|--|
| United States Naval Academy |  |                        |  |
| Last Audit Date:            |  | Date of Current Audit: |  |

**Table D-1 - Program Responsibilities.**

| Reference (a)                      | Item                                                                                                                                                                        | Yes                      | No                       | N/A                      | Comment |
|------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 1.5.2.1.a<br>Section 2.7.1 | 1. Is a written RASP radiological controls program established and is it endorsed by Command? (Directives, operating and emergency procedures require Command endorsement)? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.7.1.2                    | 2. Does the command RASP address the following topics at a minimum?                                                                                                         |                          |                          |                          |         |
|                                    | a. Radiation safety training                                                                                                                                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                                    | b. Audits, surveillances and APRs                                                                                                                                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                                    | c. Operating and emergency procedures                                                                                                                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                                    | d. Logs and records                                                                                                                                                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                                    | e. Radiological posting and labeling                                                                                                                                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                                    | f. Surveys and inspections                                                                                                                                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                                    | g. Incidents                                                                                                                                                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                                    | h. Reports and notifications                                                                                                                                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                                    | i. RSO approval prior to the purchase or receive a transfer of radioactive material or ionizing radiation producing machine                                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 1.5.2.1.e                  | 3. Is the Radiation Safety Officer (RSO) and an Assistant Radiation Safety Officer (ARSO) appointed in writing by the Commander/Commanding Officer/OIC?                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 1.5.2.1.e.(1)              | 4. Do the RSO and ARSO have the authority to immediately halt any RASP operations considered unsafe?                                                                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

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| Reference (a)         | Item                                                                                                                                                                                                                                                                 | Yes                      | No                       | N/A                      | Comment |
|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 1.5.2.1.e.(1) | 5. Do the RSO and ARSO have written authority allowing direct access to the Commanding Officer on matters dealing with radiation safety?                                                                                                                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 1.5.2.1.e.(2) | 6. Is only one RSO assigned to a command unless otherwise approved by NAVSEA DET RASO?                                                                                                                                                                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 1.5.2.1.e.(3) | 7. Are the RSO and ARSO positions filled by government employees and not outsourced to the private sector?                                                                                                                                                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 1.5.2.1.f     | 8. Is the RSO or ARSO required to be available to execute their duties in order for RASP operations to take place?                                                                                                                                                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 1.5.2.1.g     | 9. Is the RSO or ARSO required to respond within normal commuting time (<2 hours) to a radiological emergency when RASP operations are being performed?                                                                                                              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 1.5.2.1.o     | 10. Has a written agreement been established with the supporting Medical Treatment Facility (MTF) for services provided by the MTF that are associated with the RASP (e.g., radiation medical exams, dosimetry, emergency response)?                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.2.2.4       | 11. Have the methods that have been used to maintain radiation exposures As Low As Reasonably Achievable (ALARA) been documented in the Annual Program Review (APR)?                                                                                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.2.2.4.a     | 12. Does the APR demonstrate by measurement and/or calculation that the TEDE to an individual member of the public likely to receive the highest dose from RASP operations shall not exceed the annual dose limit for individual members of the public in Table 2-1? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

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| Reference (a)     | Item                                                                                                                                                                         | Yes                      | No                       | N/A                      | Comment |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 2.3.1     | 13. Has the command RASP established the radiation exposure and internal intake limits based on NAVMED P-5055 and Title 10 Part 20 of the Code of Federal Regulations (CFR)? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.4.2.1   | 14. If radiation worker ACLs were raised, was written approval of the individual's Commander, Commanding Officer (CO), or Officer in Charge (OIC) obtained?                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 3.2.1.6.a | 15. Is the NRMP accurate and current?                                                                                                                                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 3.2.3.1   | 16. Was the NRMP updated to reflect changes in the following:                                                                                                                |                          |                          |                          |         |
|                   | a. Changes in RSO/ARSO                                                                                                                                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                   | b. Changes to documents submitted or referenced in the NRMP                                                                                                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                   | c. Changes to supporting procedures or instructions                                                                                                                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                   | d. Changes or additions of the type and or quantity of radionuclides                                                                                                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

**Table D-2 - Radiation Health and Dosimetry.**

| Reference (a)   | Item                                                                                                                                                               | Yes                      | No                       | N/A                      | Comment |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 2.5.2.3 | 1. Regardless of anticipated/measured annual doses, are personnel participating in the following activities enrolled in the radiation medical examination program? |                          |                          |                          |         |
|                 | a. Industrial radiography (gamma or X-ray)                                                                                                                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                 | b. Operating research accelerators                                                                                                                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                 | c. Portable density gauges containing radioactive material                                                                                                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                 | d. Entering posted radiation/high radiation areas                                                                                                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                 | e. Contamination control work with unsealed sources of radioactivity                                                                                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                 | f. Handling radioactive material requiring a NRMP                                                                                                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

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| Reference (a)    | Item                                                                                                                                                                                                                                           | Yes                      | No                       | N/A                      | Comment |
|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
|                  | g. Assigned as a RSO, ARSO, or radiation protection specialist at a command with a NRMP                                                                                                                                                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.26.4.2 | 2. In addition to the paper copies in an employee's medical record, does the command or a designated central repository maintain a copy of each employee's external and internal radiation exposure results indefinitely in a secure location? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.26.4.3 | 3. Are annual exposure notification reports provided in writing and contain, at a minimum, the year for which the report applies, the name of the command, the name of the individual monitored, and the individual's exposure information?    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.26.4.3 | 4. Are annual exposure notification reports maintained indefinitely?                                                                                                                                                                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.6.2.1  | 5. Are RASP personnel monitored with BUMED approved primary dosimeters that are processed by the Naval Dosimetry Center or other dosimeter processing laboratories authorized by SEA 09R?                                                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.6.2.3  | 6. Are primary dosimeters worn on the front trunk of the body between the shoulder line and the waist?                                                                                                                                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.6.3.1  | 7. Do RASP personnel use ion chamber pocket dosimeters (IPD) (IM Series/PD) or electronic personal dosimeters (EPD) as secondary dosimeters depending on the operations?                                                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.6.3.2  | 8. Are only secondary dosimeters approved by NAVSEA DET RASO used when working in high and very high radiation areas, and when determined necessary by the responsible RSO?                                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.6.3.4  | 9. Are secondary dosimeters used with each primary dosimeter and worn adjacent to the primary dosimeter?                                                                                                                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                  | 10. Are secondary dosimeters read at the following times?                                                                                                                                                                                      |                          |                          |                          |         |

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| Reference (a)    | Item                                                                                                                                                                                                                                                          | Yes                      | No                       | N/A                      | Comment |
|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 2.6.3.6  | a. When initially issued.                                                                                                                                                                                                                                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                  | b. Just prior to commencing operations.                                                                                                                                                                                                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                  | c. Between each exposure or evolution during operations.                                                                                                                                                                                                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                  | d. Periodically, when in a high radiation area.                                                                                                                                                                                                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                  | e. At the end of operations.                                                                                                                                                                                                                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.6.3.9  | 11. Are secondary dosimeters response checked at intervals not to exceed the periods required by NAVSEA SE700-AA-MAN-100/Radiation Detection, Indication and Computation (RADIAC), Policies and Procedures Manual or one year, whichever is most restrictive? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.6.3.10 | 12. Are EPD dose and dose rate alarm set points set by a RADIAC calibration laboratory at 200 mrem (2 mSv) and 200 mrem/hr (2 mSv/hr), respectively?                                                                                                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.6.4    | 13. Are EPDs checked upon issuance to ensure they are operating properly as follows?                                                                                                                                                                          |                          |                          |                          |         |
|                  | a. Verify the EPD has an orange cap.                                                                                                                                                                                                                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                  | b. Verify the EPD display indicates 0.0 mrem (may require a reset to 0.0 mrem).                                                                                                                                                                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                  | c. Ensure the calibration (verification) date is not expired.                                                                                                                                                                                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                  | d. Ensure the EPD is not damaged (e.g., cracked display, broken clip, case, or lanyard, illegible serial number, punctured beta window).                                                                                                                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                  | e. Verify the EPD indicates no icons on the left side of the digital readout.                                                                                                                                                                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                  | f. Ensure the EPD alarm functions properly as evidenced by testing the alarm.                                                                                                                                                                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.26.2.1 | 14. Are calibration and response check records for secondary dosimeters maintained for three years?                                                                                                                                                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                  | 15. Do secondary dosimetry logs contain the following information at a minimum?                                                                                                                                                                               |                          |                          |                          |         |

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| Reference (a)    | Item                                                                                                       | Yes                      | No                       | N/A                      | Comment |
|------------------|------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 2.26.2.2 | a. Command name.                                                                                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                  | b. Date of dosimeter issue.                                                                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                  | c. Name of individual to whom issued.                                                                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                  | d. Dosimeter serial number.                                                                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                  | e. Initial secondary dosimeter reading.                                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                  | f. Final secondary dosimeter reading.                                                                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                  | g. Net secondary dosimeter reading (final minus initial).                                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                  | h. Initials or digital signature of the user verifying that the information entered in the log is correct. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.26.2.3 | 16. Are secondary dosimeter logs maintained for at least three years after the date of the final entry?    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

**Table D-3 - RASP Annual Program Review (APR).**

| Reference (a)  | Item                                                                                                                                                                                            | Yes                      | No                       | N/A                      | Comment |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 2.10.2 | 1. Is the requirement to conduct an Annual Program Review (APR) included in each command RASP instruction?                                                                                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.10.3 | 2. Does the APR address the following topics?                                                                                                                                                   |                          |                          |                          |         |
|                | a. A review of the exposure control processes that are in place to ensure doses are maintained <b>ALARA</b> .                                                                                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                | b. A review of operating and emergency procedures to ensure compliance with governing regulations and that they are current. Include a list of the procedures and any identified discrepancies. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                | c. Identification of any improvements to the RASP.                                                                                                                                              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                | d. A review of RASP operations with the highest personnel doses to identify opportunities to reduce these exposures.                                                                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

| Reference (a)       | Item                                                                                                                                                                                                                                                 | Yes                      | No                       | N/A                      | Comment |
|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
|                     | e. A review of personnel exposure records that includes the individuals with the five highest annual radiation doses, those individuals with annual doses above 100 mrem (1 mSv), and the cumulative radiation dose total for all radiation workers. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                     | f. A list of personnel who had their ACL raised and their resulting radiation exposures.                                                                                                                                                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                     | g. A review of all RASP related training.                                                                                                                                                                                                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                     | h. A demonstration of compliance with dose limits for individual members of the public.                                                                                                                                                              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                     | i. The results of the annual RDR trend report conducted by the RSO.                                                                                                                                                                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                     | j. A review of all incident and critique reports, associated corrective actions, and the effectiveness of those corrective actions.                                                                                                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                     | k. A summary of RASP operation surveillances and results.                                                                                                                                                                                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                     | l. A review of audit findings, responses, and audit effectiveness.                                                                                                                                                                                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section<br>2.26.7.1 | 3. Do APR records include the following information?                                                                                                                                                                                                 |                          |                          |                          |         |
|                     | a. The APR date(s).                                                                                                                                                                                                                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                     | b. The name of the person(s) conducting the review.                                                                                                                                                                                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                     | c. The names of the persons contacted by the reviewers.                                                                                                                                                                                              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section<br>2.26.7.2 | 4. Are APR records maintained for three years after the date the review is completed?                                                                                                                                                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

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**Table D-4 - Contractor Use of NRC Licensed Radioactive Material or Machine Sources of Ionizing Radiation While Performing DON Work.**

| Reference (a)    | Item                                                                                                                                                             | Yes                      | No                       | N/A                      | Comment |
|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 2.28.2.1 | 1. Is the command authorized by NAVSEA 09R to issue contracts involving RASP type work (commands shall formally request this authorization via NAVSEA DET RASO)? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.28.2.2 |                                                                                                                                                                  |                          |                          |                          |         |

**Table D-5 - Registration of Ionizing Radiation Producing Machines and Equipment.**

| Reference (a)   | Item                                                                                                                                                                | Yes                      | No                       | N/A                      | Comment |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 3.5.2.1 | 1. Has the command registered all required machines and equipment that produce ionizing radiation with NAVSEA DET RASO before placing them in routine operation?    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 3.5.2.5 | 2. Has the command retained its current registration certificate and cover letter for five years after the certification expiration date?                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 3.5.3.1 | 3. Has the command kept its registration(s) current and at a minimum, resubmitted the registration form and cover letter every five years even if no changes occur? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

**Table D-6 - RASP Radiation Source Receipt and Accountability.**

| Reference (a)    | Item                                                                                                                                                                                                                     | Yes                      | No                       | N/A                      | Comment |
|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 2.13.1.1 | 1. Has the command established written procedures to ensure RSO approval of the acquisition of any source of ionizing radiation including those from radioactive materials and radiation producing machines and devices? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.13.1.2 | 2. Does RSO approval occur prior to requisition, purchase, or transfer of ownership?                                                                                                                                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

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| Reference (a)    | Item                                                                                                                                                                                                                                                                                                           | Yes                      | No                       | N/A                      | Comment |
|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 2.13.2.1 | 3. Does the commands maintain logs that document the receipt and transfer of radioactive material and sources, and radiation producing machines and devices?                                                                                                                                                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.13.2.2 | 4. Does the command complete a National Source Tracking Transaction Report, NRC Form 748 when transferring, receiving, disassembling, or disposing of a sealed source containing a quantity equal to or greater than Category 1 or Category 2 levels of any radioactive material listed 10 CFR 20, Appendix E? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

**Table D-7 - Operating and Emergency Procedures.**

| Reference (a)    | Item                                                                                                                                                                                           | Yes                      | No                       | N/A                      | Comment |
|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 2.14.1.1 | 1. Has the command developed and maintained operating and emergency procedures for the safe use of radioactive material and radiation producing machines and devices?                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.14.1.3 | 2. Are operating and emergency procedures reviewed and approved by the command RSO?                                                                                                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.14.1.4 | 3. Are the operating and emergency procedures a command level instruction or part of a command endorsed RASP instruction?                                                                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.14.1.7 | 4. Are operating procedures not just a reprint of the manufacturer's operating manual, but incorporate the specific procedures and processes required by the command to safely use the device? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                  | 5. Do operating and emergency procedures address the following as appropriate?                                                                                                                 |                          |                          |                          |         |

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| Reference (a)       | Item                                                                                                                                                                                                | Yes                      | No                       | N/A                      | Comment |
|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section<br>2.14.2.1 | a. Be specific to each RASP operation, each piece of equipment, and facility/location. Use of portable equipment at multiple temporary sites outside a permanent facility constitutes one location. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                     | b. Specify requirements for the use of primary and secondary dosimeters as required.                                                                                                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                     | c. Specify requirements for engineered controls and equipment.                                                                                                                                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                     | d. Specify contamination controls to be used when working with unsealed radioactive material.                                                                                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                     | e. Specify requirements for radiation protection surveys necessary to ensure RASP operations are conducted safely to include any special instrumentation and airborne monitoring for radioactivity. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                     | f. Specify requirements for checking safety features such as lights, alarms, and interlocks.                                                                                                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                     | g. Specify the personal qualifications required to perform the operation, and if applicable, internal monitoring required when working with unsealed radioactive material.                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                     | h. Specify and provide representative examples of all logs, records, and forms required to support each operation.                                                                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                     | i. Include or reference another document that has current and accurate information on persons to be notified in the event of a radiological incident, and specify the method of notification.       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                     | j. Specify procedures to use in case of a radiological incident, including shutting down the affected equipment and securing the area.                                                              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

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| Reference (a)     | Item                                                                                                                                                                                                           | Yes                      | No                       | N/A                      | Comment |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
|                   | <b>k.</b> Specify that the RSO or ARSO shall be able to respond to an on-site radiological incident within the time required for normal commuting (<2 hours) to the command for RASP operations to take place. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.26.14.2 | <b>6.</b> Are copies of operating and emergency procedure records maintained indefinitely?                                                                                                                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

**Table D-8 - Reporting Radiological Incidents.**

| Reference (a)    | Item                                                                                                                                                                                                                                        | Yes                      | No                       | N/A                      | Comment |
|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 2.23.1.3 | <b>1.</b> Were radiological incidents reported per RAD-010 Section 2.27 as follows:                                                                                                                                                         |                          |                          |                          |         |
| Section 2.27.1.1 | <b>a.</b> Each command shall, upon discovery of the event, immediately report to NAVSEA DET RASO any event listed in Section 2.23.                                                                                                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.27.1.2 | <b>b.</b> Initial notification shall be made by telephone to NAVSEA DET RASO ((757) 887-4692). If after normal work hours, the command shall contact the emergency number provided on NAVSEA DET RASO's after-hours voice message.          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.27.1.3 | <b>c.</b> Initial follow up written reports shall be made within 10 days with update reports to be determined by NAVSEA DET RASO.                                                                                                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.27.1.4 | <b>2.</b> Does the written report include the following?                                                                                                                                                                                    |                          |                          |                          |         |
|                  | <b>a.</b> A description of the operation; date; time; location; individual(s) involved; doses received; isotopes, quantities, chemical and physical form; manufacturer and model number of any equipment that failed or malfunctioned, etc. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                  | <b>b.</b> A description of the circumstances under which the accident or incident occurred.                                                                                                                                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

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| Reference (a)    | Item                                                                                                                                                                                                                                                                                                                             | Yes                      | No                       | N/A                      | Comment |
|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
|                  | c. Exposures of individuals to radiation, circumstances under which the exposures occurred, and the possible total effective dose equivalent to persons in unrestricted areas.                                                                                                                                                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                  | d. A determination of the cause(s), immediate actions taken, long-term corrective actions planned to prevent recurrence, and the plan of actions and milestones (POAM).                                                                                                                                                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                  | e. An assessment of the radiological significance of the event.                                                                                                                                                                                                                                                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                  | f. Signature of the Commander, CO, or OIC.                                                                                                                                                                                                                                                                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.23.2.1 | 3. Were procedures that identify conditions constituting an emergency developed to include a list, by priority, of individuals and departments to be notified (primary and alternates) during duty hours and off-duty hours, radiological exposure controls and actions to be taken to include responsibility for notifications? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.23.2.2 | 4. Did the RSO prepare for the possibility of an emergency by developing, testing, and maintaining an emergency response plan commensurate with the radiation hazards at the command?                                                                                                                                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.23.2.3 | 5. Were emergency plans for radioactive material included in the NRMP application submitted to NAVSEA DET RASO?                                                                                                                                                                                                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.23.2.4 | 6. Were emergency plans reviewed and updated at least annually?                                                                                                                                                                                                                                                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

| Reference (a)      | Item                                                                                                                                                                                                                                                                                                          | Yes                      | No                       | N/A                      | Comment |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 2.23.2.5.a | 7. Have commands that have the potential for one or more of the hazardous conditions, conducted at least one emergency drill per year to ensure that RASP workers, radiation safety, emergency responders and other personnel are familiar with their roles and responsibilities during emergency situations? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.23.2.5.b | 8. Was the drill scenario based on one or more of the emergency situations outlined in the command emergency procedures and include participation by fire department and other emergency response personnel if appropriate?                                                                                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

**Table D-9 - Radiological Area Posting Requirements.**

| Reference (a)    | Item                                                                                                                                                                                                                                 | Yes                      | No                       | N/A                      | Comment |
|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 2.17.1.3 | 1. Are the boundaries of controlled areas defined using existing barriers (e.g., walls, doors) or temporary barriers (e.g., ropes, fencing, containments)?                                                                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.17.1.4 | 2. Except as otherwise authorized by the NRSC, SEA 09R, or elsewhere in RAD-010, do postings use the conventional radiation caution colors and symbol prescribed by 10 CFR 20.1901?                                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.17.1.5 | 3. Are radiation and radioactive contamination related signs destroyed or defaced prior to disposal of the signs?                                                                                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.17.1.6 | 4. Are radiation areas, high radiation areas, or very high radiation areas de-posted when the area is being used for other than RASP operations and have surveys confirmed radiation levels have been restored to background levels? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

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| Reference (a)  | Item                                                                                                                                                                                                                                                                                                            | Yes                      | No                       | N/A                      | Comment |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 2.17.2 | 5. Is each use and storage area, with quantities of radioactive material greater than 10 times the quantities listed in 10 CFR 20, Appendix C, posted with a sign or signs bearing the radiation trefoil symbol and stating "Caution-Radioactive Material" that is easily viewable by anyone entering the area? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.17.4 | 6. Is each RASP radiation area conspicuously posted with a sign or signs bearing the radiation trefoil symbol and the words "Caution - Radiation Area?"                                                                                                                                                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.17.5 | 7. Is each RASP high radiation area conspicuously posted with a sign or signs bearing the radiation trefoil symbol and the words "Caution – High Radiation Area" or "Danger – High Radiation Area?"                                                                                                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.17.6 | 8. Is each RASP very high radiation area conspicuously posted with a sign or signs bearing the radiation trefoil symbol and the words "Grave Danger – Very High Radiation Area?"                                                                                                                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.17.7 | 9. Are areas where radioactive contamination exceeds the levels of Table 2-2 controlled and conspicuously posted with a sign or signs bearing the radiation trefoil symbol and the words "Caution - Radioactive Contamination Area?"                                                                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.17.8 | 10. Are areas where airborne radioactivity concentrations exceed 10 percent of the derived air concentration values of 10 CFR 20 Appendix B controlled and conspicuously posted with a sign or signs bearing the radiation trefoil symbol and the words "Caution - Airborne Radioactivity Area?"                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

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**Table D-10 - Radioactive Material - Storage, Labeling, and Control.**

| Reference (a)                        | Item                                                                                                                                                                                                                                                                                                            | Yes                      | No                       | N/A                      | Comment |
|--------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 2.16.1.1                     | 1. Is RASP radioactive material, (i.e., greater than 10 CFR 30.71, Schedule B) stored in controlled areas?                                                                                                                                                                                                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.16.1.2                     | 2. Are radioactive instrument check sources stored in a locked container when not in use that can only be accessed by the RSO, ARSO, or authorized personnel?                                                                                                                                                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.16.1.3<br>Section 2.17.1.1 | 3. Is access to RASP storage and use areas limited to individuals authorized by the command?                                                                                                                                                                                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.16.1.4                     | 4. Is the storage of RASP radioactive material in office spaces, food storage areas, or berthing areas prohibited?                                                                                                                                                                                              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.16.1.5<br>Section 2.17.2   | 5. Is each use and storage area, with quantities of radioactive material greater than 10 times the quantities listed in 10 CFR 20, Appendix C, posted with a sign or signs bearing the radiation trefoil symbol and stating "Caution-Radioactive Material" that is easily viewable by anyone entering the area? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.16.1.6                     | 6. Is RASP radioactive material used in an unrestricted area under the constant surveillance and immediate control of the RSO, ARSO or an authorized individual?                                                                                                                                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.16.2.1                     | 7. Is each container holding quantities of radioactive material greater than listed in 10 CFR 30.71, Schedule B, or 10 CFR 20, Appendix C, marked with a label bearing the radiation trefoil symbol and the words "Caution-Radioactive Material?"                                                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

| Reference (a)    | Item                                                                                                                                                                                                                                                                                                                                                                                      | Yes                      | No                       | N/A                      | Comment |
|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 2.16.2.2 | 8. Is the container also labeled with sufficient information (e.g., the radionuclide(s) present, an estimate of the quantity of radioactivity, the date when the radioactivity was estimated, radiation levels, kinds of materials) to permit individuals handling or using the radioactive material and others working in the vicinity to minimize their exposure to ionizing radiation? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.16.2.3 | 9. Are radioactive material containers internally contaminated in excess of the levels in Table 2-2 marked with a label bearing the radiation trefoil symbol and the words "Caution-Radioactive Contamination Inside?"                                                                                                                                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.16.2.5 | 10. Regardless of activity, are radioactive check sources used for instruments or the container in which they are stored marked as radioactive material?                                                                                                                                                                                                                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.16.2.6 | 11. Except as otherwise authorized by the Naval Radiation Safety Committee (NRSC), SEA 09R, or elsewhere in this manual, does the labeling use the conventional radiation caution colors and symbol prescribed by 10 CFR 20.1901?                                                                                                                                                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.16.2.7 | 12. Prior to removal or disposal of empty uncontaminated containers to unrestricted areas, are all radiation and radioactive contamination related labels removed or defaced to clearly indicate that the container no longer contains radioactive material?                                                                                                                              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

**Table D-11 - Facility Design and Shielding Review.**

| Reference (a)  | Item                                                                                                                                                                                                                                                                                                                                                                                                                               | Yes                      | No                       | N/A                      | Comment |
|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 2.24.2 | 1. Have facilities been designed and constructed so that personnel in unrestricted areas shall not be exposed to more than 2 mrem/hr (0.02 mSv/hr) at 30 cm and shall not receive more than 100 mrem (1 mSv) in one year?                                                                                                                                                                                                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.24.4 | 2. Has the command planning to build or modify facilities for RASP radiation source submitted design plans to NAVSEA DET RASO at the 35 and 100 percent design completion (or equivalent) stages (i.e., prior to construction) for review and approval?<br><br>Note: This may be correspondence with RPM to ensure appropriate actions are being completed during the design and modifications of current radiological facilities. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.24.5 | 3. Has the following information been addressed as necessary in the submission to NAVSEA DET RASO?                                                                                                                                                                                                                                                                                                                                 |                          |                          |                          |         |
|                | a. All radiation sources (radioactive material and machine produced).                                                                                                                                                                                                                                                                                                                                                              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                | b. Type and thickness of construction materials in the walls (including windows), floor, and ceiling.                                                                                                                                                                                                                                                                                                                              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                | c. Dimensions of the room in which the source is to be used. Include floor size, height from finished floor to ceiling and roof, distances to finished floors above and below the source usage room, etc.                                                                                                                                                                                                                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                | d. Location of radiation source within the shielded facility (i.e., distance from walls, floor, ceiling, and targets).                                                                                                                                                                                                                                                                                                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                | e. Presence of other nearby radiation sources which contribute to radiation levels outside the facility.                                                                                                                                                                                                                                                                                                                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

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| Reference (a) | Item                                                                                                                                                                                                                                                                                                                               | Yes                      | No                       | N/A                      | Comment |
|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
|               | <b>f.</b> Location and function of facility safety systems such as interlocks, warning lights and alarms, and access controls to radiation and high radiation areas.                                                                                                                                                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|               | <b>g.</b> Detailed drawings of penetrations through walls, ceiling, floor, or doors of shielded rooms.                                                                                                                                                                                                                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|               | <b>h.</b> Completed architectural drawings of the proposed facility (at 100 percent design stage).                                                                                                                                                                                                                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|               | <b>i.</b> Plans or design requirements that show or describe the installation shielding materials. This should include joints between sheets and panels, joints at bends (i.e., corners), door jambs, lintels, thresholds (astragal), door latches and knobs, shield penetrations, and how the shielding material will be secured. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|               | <b>j.</b> Applicable shielding calculations and assumptions for all shielded spaces in the facility (at 35 and 100 percent design stages).                                                                                                                                                                                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|               | <b>k.</b> Design criteria, specifications, and drawings for engineered systems for the control of airborne radioactivity.                                                                                                                                                                                                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

**Table D-12 - Radiation Safety Training Records.**

| Reference (a)    | Item                                                                                                                                        | Yes                      | No                       | N/A                      | Comment |
|------------------|---------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 2.26.5.2 | <b>1.</b> Are initial training records kept on file and retained for three years after the trained individual leaves the command?           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.26.5.3 | <b>2.</b> Does sanctioned Navy and RASP management/leadership training include a copy of the certificate of completion of initial training? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.26.5.6 |                                                                                                                                             |                          |                          |                          |         |

| Reference (a)    | Item                                                                                                                                                                                                                                                 | Yes                      | No                       | N/A                      | Comment |
|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 2.26.5.4 | 3. Do records for local initial training identify the training date(s), course subject matter (i.e., a brief description of the subjects covered), length of training, student test scores (if applicable), instructor name(s) and attendee name(s)? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.26.5.5 | 4. Do periodic training records identify the training date(s), course subject matter (i.e., a brief description of the subjects covered), length of training, student test scores (if applicable), instructor name(s) and attendee name(s)?          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.26.5.8 | 5. Are periodic radiation safety training records for all personnel associated with the RASP maintained by the RSO or command training office for three years after the training date?                                                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.26.5.9 | 6. Are radioactive material shipper training records maintained by the RSO for three years after the trained individual leaves the command?                                                                                                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

**Table D-13 - Radiation Worker Training.**

| Reference (a)   | Item                                                                                                                                                    | Yes                      | No                       | N/A                      | Comment |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 2.8.4.3 | 1. Does the initial training commensurate with the radiation hazards at the command and include at least the following topics?                          |                          |                          |                          |         |
|                 | a. Operating, maintenance, handling, and accountability procedures for the devices or radioactive sources used (including command specific procedures). | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                 | b. Radiation exposure limits, annual limits on intake (ALIs), and ACLs.                                                                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                 | c. Command specific RADIAC survey instrument requirements and operating procedures.                                                                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                 | d. Facility or site survey requirements and procedures (if applicable to duties).                                                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

| Reference (a)   | Item                                                                                                                                 | Yes                      | No                       | N/A                      | Comment |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
|                 | e. Command specific personnel dosimetry, internal monitoring, and/or bioassay requirements.                                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                 | f. Biological effects and risks associated with exposure to ionizing radiation from internal or external sources.                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                 | g. Sources and characteristics of ionizing radiation (i.e., alpha, beta, gamma, neutron).                                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                 | h. Command specific procedures for using time, distance, and shielding to maintain individual exposures ALARA.                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                 | i. If applicable, use of respirators or forced air systems to limit internal deposition of radioactive materials.                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                 | j. Responsibilities of individuals.                                                                                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                 | k. Emergency procedures.                                                                                                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                 | l. Biological effects of radiation exposure to the embryo/fetus.                                                                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                 | m. Results of command internal audits, inspections, and Quality Management reviews.                                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                 | n. Reporting of deficiencies into the command's RASP Deficiency Report (RDR) program.                                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                 | o. Each individual is responsible for tracking his/her own radiation exposure and exposure reports that are provided by the command. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                 | p. Notices required by 10 CFR 19 for NRMP operations regulated under the Navy Master Materials License (MML).                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.8.4.4 | 2. Do radiation workers receive annual refresher training?                                                                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.8.4.5 | 3. Does the duration of the refresher training determined by the command and cover at least the following topics?                    |                          |                          |                          |         |
|                 | a. Command RASP operating and emergency procedures.                                                                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                 | b. Use of RADIAC survey instruments.                                                                                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                 | c. Personnel dosimetry.                                                                                                              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

| Reference (a)    | Item                                                                                                                                                                 | Yes                      | No                       | N/A                      | Comment |
|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
|                  | d. Results of command internal audits, inspections, and Quality Management reviews.                                                                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                  | e. Command conducted radiation survey results and personnel exposure trends.                                                                                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                  | f. Command specific procedures for using time, distance, and shielding to maintain individual exposures ALARA.                                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                  | g. Each individual is responsible for tracking his/her own radiation exposure and exposure reports that are provided by the command.                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                  | h. Biological effects of radiation exposure to the embryo/fetus.                                                                                                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                  | i. Reporting of deficiencies into the command's RDR program.                                                                                                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                  | j. Problem trends and incidents that occurred since the last annual training.                                                                                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.8.4.7  | 4. Are trainings provided as lectures, demonstrations, video, or self-study and should emphasize the use of site-specific RASP sources?                              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.8.4.8  | 5. Does the RSO, ARSO, or an individual with comparable knowledge, training, and experience conduct the training?                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.8.4.10 | 6. Are written examinations used to demonstrate successful completion of initial and refresher training?<br><br>Note: The minimum passing score shall be 80 percent. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

**Table D-14 - Non-radiation Worker Training.**

| Reference (a)   | Item                                                                                                                | Yes                      | No                       | N/A                      | Comment |
|-----------------|---------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 2.8.6.3 | 1. Does the duration of initial training determined by the command and shall contain at least the following topics? |                          |                          |                          |         |
|                 | a. Sources of radiation in areas they may frequent.                                                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

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| Reference (a)   | Item                                                                                                                                                                                                    | Yes                      | No                       | N/A                      | Comment |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
|                 | b. Potential hazards associated with radiation sources in areas they may enter.                                                                                                                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                 | c. Biological effects and risks associated with exposure to ionizing radiation from internal or external sources.                                                                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                 | d. Use and meaning of radiation warning signs and barriers.                                                                                                                                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                 | e. Procedures to avoid and reduce radiation exposures.                                                                                                                                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                 | f. Personnel dosimetry, bioassay and/or internal monitoring requirements.                                                                                                                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                 | g. Biological effects of exposure to the embryo/fetus if the person will receive greater than 100 mrem per year.                                                                                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                 | h. Each individual is responsible for tracking his/her own radiation exposure and exposure reports that are provided by the command.                                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.8.6.4 | 2. Does each non-radiation worker receive annual refresher training? Does the duration of training shall be determined by the command and cover at least the scope of the initial training requirement? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.8.6.7 | 3. Does the RSO, ARSO, or an individual with comparable knowledge and training conduct the training?                                                                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

**Table D-15 - RASP Deficiency Report Program Requirements and Records.**

| Reference (a)    | Item                                                                                                                    | Yes                      | No                       | N/A                      | Comment |
|------------------|-------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 2.11.1.2 | 1. Has the command established a RASP Deficiency Report (RDR) program or use an existing system?                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.11.1.5 | 2. Is each RDR deficiency assigned a level of significance (incident, potential incident, deficiency/improvement item)? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                  | 3. Does the RDR program ensure the following actions are required?                                                      |                          |                          |                          |         |

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| Reference (a)    | Item                                                                                                                                                                                                                                                                                                                                                                                                                                            | Yes                      | No                       | N/A                      | Comment |
|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 2.11.2.1 | a. Personnel to document all deficiencies, abnormal conditions, and improvement items associated with the command's RASP.                                                                                                                                                                                                                                                                                                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                  | b. Supervisors ensure the actions taken to correct the deficiencies and abnormal conditions are appropriate and documented.                                                                                                                                                                                                                                                                                                                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                  | c. RSO or ARSO review of each RASP deficiency or abnormal condition and corrective action.                                                                                                                                                                                                                                                                                                                                                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                  | d. The RSO to review RDRs and perform a trend analysis as part of the semiannual (or annual) audit.                                                                                                                                                                                                                                                                                                                                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                  | e. Each RDR is assigned a level of significance.                                                                                                                                                                                                                                                                                                                                                                                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                  | f. The RDR form (or other comparable system) provides for documentation of the problem, date of discovery, 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 RSO or ARSO review and comment. The form should be annotated with a serial number comprised of the two-digit year and sequential number. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                  | g. A log be maintained that records, as a minimum, the RDR serial number, date, short problem description, and date RDR reviewed and closed out by the RSO or ARSO.                                                                                                                                                                                                                                                                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.11.2.3 | 4. Are causal analysis and corrective actions identified for all incidents and potential incidents?                                                                                                                                                                                                                                                                                                                                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.9.1.7  | 5. Has a review of RDRs and analysis to detect any trends been accomplished every year?                                                                                                                                                                                                                                                                                                                                                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.26.8.1 | 6. Have deficiencies been documented?                                                                                                                                                                                                                                                                                                                                                                                                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.26.8.2 | 7. Is a running log of RDR's maintained?                                                                                                                                                                                                                                                                                                                                                                                                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

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| Reference (a)    | Item                                                                                                                                                                                                                                 | Yes                      | No                       | N/A                      | Comment |
|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 2.26.8.3 | 8. Has the annual evaluation and trend analysis of RDR deficiencies been issued as a memorandum to the Commander, CO, or OIC (copies of the memorandum shall be provided to senior command managers and RASP personnel supervisors)? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.26.8.4 | 9. Are electronic or paper copies of RDR's maintained for three years?                                                                                                                                                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

**Table D-16 - Radiation Survey Instrumentation.**

| Reference (a)      | Item                                                                                                                                                                                                             | Yes                      | No                       | N/A                      | Comment |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 2.12.1.3   | 1. Are only RASP-approved radiation survey instruments or those approved per NAVSEA DET RASO used?                                                                                                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.12.2.1.c | 2. Are radiation detection instruments not listed in NAVSEA SE700-AAMAN-100/RADIAC approved by NAVSEADET prior to use by a RASP command?                                                                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.12.2.2.a | 3. Are instruments and equipment used for quantitative radiation measurements calibrated for the type of radiation to be measured and periodically calibrated and/or response checked at specified intervals?    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.12.2.2.b | 4. Are instruments and equipment used for quantitative radiation measurements calibrated by an activity specifically authorized by an NRMP or an NRC license or Agreement State license to provide this service? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.12.2.2.e | 5. Are RASP RADIAC instruments or other approved instruments response checked using appropriate radioactive sources either daily or before use, if not used daily, as appropriate?                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.26.9.2   | 6. Are radiation detection instruments inventory, calibration, and response check records maintained for three years?                                                                                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

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**Table D-17 - Radiation Surveys.**

| Reference (a)    | Item                                                                                                                                                                                                                             | Yes                      | No                       | N/A                      | Comment |
|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 2.21.2.1 | <b>1. Are radiation surveys conducted at a minimum under the following conditions?</b>                                                                                                                                           |                          |                          |                          |         |
|                  | <b>a. Monthly in <u>occupied</u> radiation area, high radiation areas, radioactive material storage areas, and areas adjacent to these areas</b>                                                                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                  | <b>b. At least annually in <u>unoccupied</u> radiation areas, high radiation areas, and radioactive material storage areas even if the are must be opened to perform the survey.</b>                                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.21.2.2 | <b>2. Are radiation surveys performed on radiation producing machines or facilities after maintenance that involves unit shielding or could change radiation levels emitted?</b>                                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.21.2.3 | <b>3. Are radiation surveys conducted in controlled and adjacent uncontrolled areas during or after movement of radioactive material or radiation producing machines that could result in a change in area radiation levels?</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

**Table D-18 - Contamination Surveys.**

| Reference (a)    | Item                                                                                                                                                                                | Yes                      | No                       | N/A                      | Comment |
|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 2.21.3.1 | <b>1. Are radiation surveys conducted at a minimum under the following conditions?</b>                                                                                              |                          |                          |                          |         |
|                  | <b>a. Daily in occupied radiative contamination areas, control point areas, and area immediately adjacent to control point areas</b>                                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                  | <b>b. Monthly in all areas of facilities where contaminated or potentially contaminated materials are used or stored</b>                                                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.21.3.3 | <b>2. Are surveys performed on areas where spills of radioactive liquid have occurred or airborne radioactivity exceeded the derived air concentration of appendix B 10 CFR 20?</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

**Table D-19 - Facility Radiation Surveys.**

| Reference (a)      | Item                                                                                                                                                                                                                                                                           | Yes                      | No                       | N/A                      | Comment |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 2.21.4.2   | 1. Does the facility radiation survey include a physical inspection of the facility and operation and measurements of the radiation levels under a full range of expected operating conditions?                                                                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.21.4.4   | 2. Does the survey documentation clearly identify all adjacent areas including unrestricted areas?                                                                                                                                                                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| 2.21.4.5           | 3. Does the survey indicate present and expected future occupancy factors for adjacent areas?                                                                                                                                                                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.21.4.6   | 4. Were radiation levels measured in all adjacent areas that could be occupied?                                                                                                                                                                                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.21.4.6.a | 5. Were measurements made under practical conditions that will produce the highest exposure at the point of interest?                                                                                                                                                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.21.4.7   | 6. Were radiation protection equipment and systems tested for proper operation (these devices include audible or visible warning signals, interlocks, emergency stops, timer delay switches, and mechanical or electronic devices that restrict radiation source positioning)? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.21.4.8   | 7. Did the RSO or ARSO review all associated RASP instructions and procedures to ensure they are up to date?                                                                                                                                                                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.21.4.9   | 8. Did the RSO or ARSO conduct or supervise all facility radiation surveys?                                                                                                                                                                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.21.4.10  | 9. Was a facility radiation survey conducted for the following situations?                                                                                                                                                                                                     |                          |                          |                          |         |
|                    | a. Before a new facility is placed into routine operations.                                                                                                                                                                                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                    | b. Following a significant change in conditions from the initial facility radiation survey that could adversely affect radiation safety (e.g., facility modification, change in operating parameters, etc.).                                                                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

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| Reference (a)       | Item                                                                                                                                                                      | Yes                      | No                       | N/A                      | Comment |
|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
|                     | c. Every five years unless specified otherwise by NRMP condition or in other sections in this manual.                                                                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.21.4.13.a | 10. Were surveys submitted to NAVSEA DET RASO for evaluation and approval?                                                                                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.21.4.13.b | 11. Were routine operation of new or modified facilities prohibited prior to NAVSEA DET RASO approval of the corresponding radiation protection survey?                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.21.4.13.c | 12. Did commands observing unexpected survey results notify NAVSEA DET RASO immediately and suspend operations in the affected facility pending NAVSEA DET RASO guidance? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

**Table D-20 - Survey Records.**

| Reference (a)     | Item                                                                                                                                                                  | Yes                      | No                       | N/A                      | Comment |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 2.26.19.1 | 1. Do radiation survey records include the following information at a minimum?                                                                                        |                          |                          |                          |         |
|                   | a. The survey date and time.                                                                                                                                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                   | b. The name of the person(s) conducting the survey.                                                                                                                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                   | c. The nomenclature for the radiation source and installation (e.g., sealed or machine source model and serial numbers; and building name or number and room number). | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                   | d. The identity of the radiation survey instruments used, including model and serial numbers, and dates of last calibration.                                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                   | e. The source intensity in roentgens per hour at one meter or source activity in curies for a beta-gamma source.                                                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                   | f. The radiation source location at the time of the survey.                                                                                                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                   | g. The date the RSO reviewed the survey and his or her signature.                                                                                                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

**Table D-21 - Facility Radiation Surveys – Additional Record Requirements.**

| Reference (a)        | Item                                                                                                                                                                                                                                                                                                    | Yes                      | No                       | N/A                      | Comment |
|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section<br>2.26.19.2 | <b>1. Do shielded facility radiation surveys include the following information?</b>                                                                                                                                                                                                                     |                          |                          |                          |         |
|                      | <b>a.</b> The location of nearby workstations and the current and expected occupancy of the workstations and adjacent areas to the radiation area.                                                                                                                                                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                      | <b>b.</b> An indication of required warning sign(s) posting locations, and personnel occupancy restrictions.                                                                                                                                                                                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                      | <b>c.</b> A list of devices having a bearing on radiation protection requirements and their operational status.                                                                                                                                                                                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                      | <b>d.</b> A statement indicating the appropriate facility classification provided by NAVSEA DET RASO.                                                                                                                                                                                                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                      | <b>e.</b> Pertinent exposure conditions including the type, amount, and location of scatter material (e.g., objects typically imaged in a radiography vault) intentionally introduced into the primary radiation beam, and the orientation of the useful beam in relation to each exposure measurement. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                      | <b>f.</b> The exposure rates in all adjacent occupied and unoccupied areas (facility drawings shall be used to identify measurement locations).                                                                                                                                                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                      | <b>g.</b> A statement of the restrictions, if any, that shall be placed on the weekly workload, occupancy, or time that the useful beam may be directed at any facility barrier.                                                                                                                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                      | <b>h.</b> The action(s) required to ensure compliance, including resurveys, shall be included in the survey report when a facility is found not to comply with its designed requirements.                                                                                                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section<br>2.26.19.3 | <b>2. Are facility radiation survey records maintained indefinitely?</b>                                                                                                                                                                                                                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

**Table D-22 - Research Accelerator - Additional Radiation Survey Requirements.**

| Reference (a)     | Item                                                                                                                                                                                                                                                                                                          | Yes                      | No                       | N/A                      | Comment |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 12.1.8.1  | <b>1. Are operable and calibrated, portable ion chamber survey instruments available at each electron accelerator facility?</b><br><br>Note: The instruments shall be calibrated for radiations being produced by the accelerator, shielded for radio-frequency interference and approved by NAVSEA DET RASO. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 12.1.8.3  | <b>2. For electron accelerators operating at energy levels greater than 10 MeV, are neutron survey instruments available?</b>                                                                                                                                                                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 12.1.8.4  | <b>3. Are survey instruments calibrated at least every six months and after each repair or servicing?</b>                                                                                                                                                                                                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 12.1.10.2 | <b>4. Is a facility radiation survey performed and documented by a qualified operator when changes have been made in shielding, operation, equipment, or occupancy of adjacent areas that could adversely affect radiation safety?</b>                                                                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 12.1.10.5 | <b>5. After operation of the accelerator, is a radiation survey conducted by the operator upon initial entry into an exposure room to verify the accelerator is off and to identify any radiation hazards due to neutron activation (for operation above 10 MeV)?</b>                                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

**Table D-23 - Analytical X-ray Equipment and Scanning Electron Microscope – Surveys.**

| Reference (a)    | Item                                                                          | Yes                      | No                       | N/A                      | Comment |
|------------------|-------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 13.4.2.9 | <b>1. Does the Laboratory Manager perform a radiation survey as follows?</b>  |                          |                          |                          |         |
|                  | <b>a. Prior to placing a new unit in service and semiannually thereafter.</b> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                  | <b>b. Immediately after maintenance or repair.</b>                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                  | <b>c. After shock, earthquake, etc., or suspected deficiency.</b>             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

| Reference (a)     | Item                                                                                                                                                                                                                                                                         | Yes                      | No                       | N/A                      | Comment |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
|                   | d. When major beam realignment is in progress.                                                                                                                                                                                                                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                   | e. Whenever equipment is modified.                                                                                                                                                                                                                                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 13.4.2.10 | 2. Are radiation survey measurements made with the unit operating at a voltage and beam current that yields the highest output?                                                                                                                                              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 13.4.2.11 | 3. Does the radiation survey include the following?                                                                                                                                                                                                                          |                          |                          |                          |         |
|                   | a. Viewing column area                                                                                                                                                                                                                                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                   | b. High voltage power supply                                                                                                                                                                                                                                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                   | c. Lens column                                                                                                                                                                                                                                                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                   | d. Penetrations into the column                                                                                                                                                                                                                                              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                   | e. Control console                                                                                                                                                                                                                                                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                   | f. Electron beam target area                                                                                                                                                                                                                                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                   | g. High voltage generator tanks for high voltage electron microscopes (greater than 200 kVp)                                                                                                                                                                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 13.4.2.11 | 4. Are installed interlocks tested under shall be tested per manufacturer instructions?                                                                                                                                                                                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 13.4.2.4  | 5. Are radiation survey levels equal to or less than 0.5 mrem/hr (5.0 microSv/hr) five centimeters from any external surface of the unit?                                                                                                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.21.4.7  | 6. Is radiation protection equipment and systems tested for proper operation (these devices include audible or visible warning signals, interlocks, emergency stops, timer delay switches, and mechanical or electronic devices that restrict radiation source positioning)? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

**Table D-24 - Leak Testing of Sealed Radioactive Sources - General Requirements.**

| Reference (a)    | Item                                                                                                                                                                                                                                                                                                                                                                                            | Yes                      | No                       | N/A                      | Comment |
|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 2.19.1.1 | <p><b>1. Are sealed sources tested for leakage or contamination at intervals not to exceed the period specified in the applicable NRMP or the NRC Sealed Source and Device Registry (SSDR), whichever is more restrictive?</b></p> <p>Note: Sealed sources designed to emit primarily alpha particles shall be tested for leakage or contamination at intervals not to exceed three months.</p> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.19.1.4 | <b>2. Are newly received sealed source (requiring leak testing) accompanied by a certificate from the transferor that shows it has been successfully leak tested as specified by the SSDR?</b>                                                                                                                                                                                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.19.1.5 | <b>3. Are sealed sources in storage and not being used tested before use or transfer to another command if the storage interval exceeds the interval stated in the NRMP or certificate of registration, or if stored for a period of more than 10 years without being tested for leakage?</b>                                                                                                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.19.2.1 | <b>4. Are leak test samples taken from the source or an adjacent surface where contamination is expected to accumulate?</b>                                                                                                                                                                                                                                                                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.19.2.2 | <b>5. Are sources that emit alpha particles (i.e., plated and Mylar covered alpha check sources) tested by wiping an adjacent surface and not the source directly?</b>                                                                                                                                                                                                                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.19.2.4 | <b>6. Are leak test samples analyzed by the command, or a company specifically licensed by the NRC or an Agreement State, or another command authorized by a NRMP to perform such services?</b>                                                                                                                                                                                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

| Reference (a)    | Item                                                                                                                                                                                                                                 | Yes                      | No                       | N/A                      | Comment |
|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 2.19.2.5 | 7. Is leak test analysis capable of detecting the presence of 0.005 microcuries (185 Becquerels (Bq)) of radioactive material (this analysis shall also be able to accurately identify the radionuclide present in the test sample)? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

**Table D-25 - Leak Testing of Sealed Radioactive Sources - Records.**

| Reference (a)     | Item                                                                                                                                                              | Yes                      | No                       | N/A                      | Comment |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 2.26.17.1 | 1. Do leak test records include the following information at a minimum?                                                                                           |                          |                          |                          |         |
|                   | a. The identity of each source or device (i.e., source or device manufacturer, model number, serial number, isotope, and quantity).                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                   | b. The identity of the command possessing the source.                                                                                                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                   | c. The leak test date and next scheduled leak test date.                                                                                                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                   | d. The leak test methods used (e.g., dry filter paper or wet cloth swipe and areas wiped).                                                                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                   | e. The leak-test results expressed in Becquerels (microcuries), for each area wiped.                                                                              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                   | f. A description of the equipment used to analyze the leak test (i.e., counting instrument manufacturer, model number, and serial number).                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                   | g. The name of the organization and person performing the test.                                                                                                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                   | h. The name and dated signature of the certifying individual.                                                                                                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.26.17.2 | 2. If the results of leak tests are expressed as less than the minimum detectable activity (MDA), is the MDA specified in addition to other required information? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.26.17.3 | 3. Are leak test records maintained indefinitely?                                                                                                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

**Table D-26 - RASP Audit Requirements.**

| Reference (a)   | Item                                                                                                                                                          | Yes                      | No                       | N/A                      | Comment |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 2.9.1.1 | 1. Has a formal audit program been established and addressed in the command endorsed RASP instruction?                                                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.9.1.6 | 2. Does the audit program cover the following areas?                                                                                                          |                          |                          |                          |         |
|                 | a. Procedures, and the NRMP if applicable, are being properly maintained and are current.                                                                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                 | b. Appropriate radiological surveys are being conducted and reviewed in a timely manner.                                                                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                 | c. Required radiation medical examinations are properly conducted at required intervals.                                                                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                 | d. Records of occupational radiation exposure are accurate and complete.                                                                                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                 | e. Exposure information is provided to workers.                                                                                                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                 | f. NRMP commitments are maintained by reconciling physical inventories, leak test records, and other items prescribed by the NRMP.                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                 | g. Required records and reports are properly maintained and issued in a timely manner.                                                                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                 | h. Radioactive material transportation, shipping, receipt, transfer, and disposal records are properly maintained.                                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                 | i. RASP related training is properly conducted and documented.                                                                                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                 | j. Deficiencies identified during previous evaluations, inspections, reviews, audits, and RDRs have been corrected and that corrective actions are effective. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.9.1.7 | 3. A review of RDRs and analysis to detect any trends.                                                                                                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

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**Table D-27 - RASP Audit Records.**

| Reference (a)    | Item                                                                                                                                             | Yes                      | No                       | N/A                      | Comment |
|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 2.26.6.2 | 1. Audit reports include the following                                                                                                           |                          |                          |                          |         |
|                  | a. The audit date(s)                                                                                                                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                  | b. The name of the person(s) conducting the audit.                                                                                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                  | c. The names of the persons contacted by the auditor(s).                                                                                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                  | d. The areas audited (including a listing of records reviewed, number of records reviewed, and operations observed).                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                  | e. All findings.                                                                                                                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                  | f. The organization responsible to address each finding.                                                                                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                  | g. A copy of the formal plan used to conduct the audit program.                                                                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.26.6.3 | 2. Is a summary of the audit results documented as a memorandum from the RSO to the Commander, CO, or OIC, who will endorse the summary?         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.26.6.5 | 3. Are records of audits, audit responses, and records of action completion maintained for a minimum of three years from the date of completion? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

**Table D-28 - RASP Surveillance Requirements.**

| Reference (a)   | Item                                                                                                                                                                                                                                                                                                                                                                  | Yes                      | No                       | N/A                      | Comment |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 2.9.2.1 | 1. Has the supervisor responsible for operations subject to RASP controls conducted and documented a surveillance of operations at least quarterly (each type of RASP operation at a command (e.g., industrial radiography, X-ray analyzer usage, radioactive material shipping) shall have a separate surveillance performed quarterly if operations are conducted)? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.9.2.1 | 2. Do surveillances include observation of work in progress?                                                                                                                                                                                                                                                                                                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

| Reference (a)   | Item                                                                                                                                                                                                                                                             | Yes                      | No                       | N/A                      | Comment |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 2.9.2.2 | 3. Does the RSO review the findings of supervisor surveillances?                                                                                                                                                                                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.9.2.3 | 4. Does the RSO conduct and document surveillances of RASP operations at least quarterly?<br><br>Note: The surveillance conducted by the supervisor and the surveillance conducted by the RSO shall not be performed by the same individual in the same quarter. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.9.2.5 | 5. Were deficiencies or improvement items noted during surveillances documented using the RDR program?                                                                                                                                                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

**Table D-29 - RASP Surveillance Records.**

| Reference (a)    | Item                                                                                                                                                                         | Yes                      | No                       | N/A                      | Comment |
|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 2.26.6.6 | 1. Do surveillance records include the following information?                                                                                                                |                          |                          |                          |         |
|                  | a. The surveillance date(s).                                                                                                                                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                  | b. The title of the person(s) performing the surveillance.                                                                                                                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                  | c. The title of the person(s) under surveillance.                                                                                                                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                  | d. A description of the areas or processes observed.                                                                                                                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                  | e. A statement discussing the outcome of the surveillance including any findings and/or actions resulting from the surveillance with actual or proposed dates of completion. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

**Table D-30 - General Inventory Requirements.**

| Reference (a)                         | Item                                                                                                                                                                                                                                                                                                                           | Yes                      | No                       | N/A                      | Comment |
|---------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 1.5.2.2.o<br>Section 2.13.3.1 | 1. Is a detailed and current inventory maintained of all radioactive material authorized on the NRMP, radioactive sources authorized by NRC general license (radioactive chemical reagents and some gauges), exempt instrument check sources, low level radioactive waste (LLRW) and radiation producing machines and devices? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.13.3.2<br>Section 2.13.3.4  | 2. Was a physical (hands on) inventory of the items described in Section 2.13.3.1 performed semiannually, (unless specified otherwise in this manual or the NRMP for the command?<br><br>Note: The RSO should be aware of NRC exempt sources and commodities containing radioactive material.                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.13.3.3                      | 3. Is radioactive material scheduled for disposal clearly identified as such in the inventory?                                                                                                                                                                                                                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.13.3.5                      | 4. Has the RSO provided a list of RASP radioactive material and radiation producing machines and devices, by facility and location, to appropriate security and fire departments at least annually or when changes occur?                                                                                                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

**Table D-31 - Radioactive Material – Inventory.**

| Reference (a)     | Item                                                                                              | Yes                      | No                       | N/A                      | Comment |
|-------------------|---------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 2.26.12.1 | 1. Does the radioactive material inventory record contain the following information?              |                          |                          |                          |         |
|                   | a. The manufacturer, model, and serial number of each sealed source and/or device, as applicable. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                   | b. A source identification number (if no serial number is available).                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                   | c. The radionuclide identity.                                                                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

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| Reference (a) | Item                                                                                                                                                                     | Yes                      | No                       | N/A                      | Comment |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
|               | d. The radionuclide chemical and physical form.                                                                                                                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|               | e. The quantity of source(s) on hand.                                                                                                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|               | f. The activity per source in curies (Becquerels) (depleted uranium, natural uranium, U-233, U-235, U-238 and plutonium quantity shall be specified in mass (i.e., kg)). | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|               | g. The activity determination date.                                                                                                                                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|               | h. The source and/or device location.                                                                                                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|               | i. The custodian's name (i.e., person in possession of the source).                                                                                                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|               | j. The physical inventory date(s) (i.e., hands on location date(s)).                                                                                                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|               | k. The name of the person(s) conducting the inventory.                                                                                                                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|               | l. The date the RSO reviewed the inventory record and his/her signature.                                                                                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

**Table D-32 - Analytical X-ray Equipment and Scanning Electron Microscope – Inventory.**

| Reference (a)     | Item                                                                                                                  | Yes                      | No                       | N/A                      | Comment |
|-------------------|-----------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 2.26.13.1 | 1. Does the machine inventory record contain the following information?                                               |                          |                          |                          |         |
|                   | a. The physical inventory date(s) (i.e., hands on location date(s)).                                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                   | b. The name of the person(s) conducting the inventory.                                                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                   | c. The manufacturer, make, model, and serial number of each machine.                                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                   | d. The location of each machine.                                                                                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                   | e. The custodian's name (i.e., person in possession of the machine).                                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                   | f. The date the RSO reviewed                                                                                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.26.13.2 | 2. Are machine source of ionizing radiation inventory records maintained for five years after the date of the record? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

**Table D-33 - General Requirements - Utilization Logs.**

| Reference (a)    | Item                                                                                                                                                               | Yes                      | No                       | N/A                      | Comment |
|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 2.15.1.1 | 1. Are utilization logs used and maintained for the following?                                                                                                     |                          |                          |                          |         |
|                  | a. Use of all unsealed radioactive material and sources.                                                                                                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                  | b. Use of sealed radioactive sources, with activities greater than 10 times the quantities listed in 10 CFR 20, Appendix C, unless otherwise authorized by a NRMP. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                  | c. Radioactive instrument check sources.                                                                                                                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                  | d. Use of all registered radiation producing machines and devices.                                                                                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

**Table D-34 - Radioactive Materials - Utilization Logs.**

| Reference (a)     | Item                                                                                                                                                             | Yes                      | No                       | N/A                      | Comment |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 2.26.15.1 | 1. Do utilization log records for radioactive sources (materials) include the following information at a minimum?                                                |                          |                          |                          |         |
|                   | a. The source serial number.                                                                                                                                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                   | b. The name(s) of individual(s) using the source.                                                                                                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                   | c. The use date and time.                                                                                                                                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                   | d. The use location.                                                                                                                                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                   | e. The date the source is returned to storage (if the source is removed from the normal storage area).                                                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                   | f. The quantity of activity used and its disposition (for unsealed sources).                                                                                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                   | g. The date the RSO reviewed the utilization log and his/her signature.                                                                                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.26.15.3 | 2. Are radioactive material utilization log records maintained for three years after the date of the last entry unless a different retention period is required? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

**Table D-35 - Research Accelerator - Utilization Logs.**

| Reference (a)                                | Item                                                                                                                                                          | Yes                      | No                       | N/A                      | Comment |
|----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 12.1.12.2                            | 1. Is a utilization log maintained for each accelerator used at the command?                                                                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.26.16.1<br><br>Section 12.1.12.2.b | 2. Do utilization log records for machine sources of ionizing radiation include the following information at a minimum?                                       |                          |                          |                          |         |
|                                              | a. The machine manufacturer, make, model, and serial number(s).                                                                                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                                              | b. Energy, current or radiation output, duration of operation and date.                                                                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                                              | c. The maximum and operating voltage (kVp) and current (mA)                                                                                                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                                              | d. The target material if applicable                                                                                                                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                                              | e. Primary beam orientation                                                                                                                                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                                              | f. Name(s) of the operator(s) and signature of the senior operator                                                                                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                                              | g. Model, serial number, and calibration dates of survey instrument(s)                                                                                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                                              | h. Initials of the operator verifying radiation survey instruments have been source checked prior to the initial exposure of the day or shift.                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                                              | i. Initials of the operator certifying that all interlocks and alarms have been checked for proper operation before the initial exposure of the day or shift. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                                              | j. The date the RSO reviewed the utilization log and his or her signature.                                                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.26.16.3                            | 3. Are machine source utilization log records maintained for three years after the date of the last entry?                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

**Table D-36 - Analytical X-ray Equipment and Scanning Electron Microscope – Utilization Log.**

| Reference (a)     | Item                                                                                                                    | Yes                      | No                       | N/A                      | Comment |
|-------------------|-------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 2.26.16.1 | 1. Do utilization log records for machine sources of ionizing radiation include the following information at a minimum? |                          |                          |                          |         |
|                   | a. The machine manufacturer, make, model, and serial number(s).                                                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

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| Reference (a)     | Item                                                                                                                                                             | Yes                      | No                       | N/A                      | Comment |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
|                   | b. The use date and time.                                                                                                                                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                   | c. The use location.                                                                                                                                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                   | d. The radiation exposure time length.                                                                                                                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                   | e. The maximum and operating voltage (kVp) and current (mA).                                                                                                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                   | f. The target material if applicable.                                                                                                                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                   | g. The name and signature of the operator.                                                                                                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                   | h. The date the RSO reviewed the utilization log and his or her signature.                                                                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.26.16.2 | 2. Are machine source utilization log records maintained for three years after the date the record is generated unless a different retention period is required? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

**Table D-37 - Analytical X-ray Equipment and Scanning Electron Microscope – General Requirements.**

| Reference (a)                         | Item                                                                                                                                                                                                                                                                                                                                                                                                                                      | Yes                      | No                       | N/A                      | Comment |
|---------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 2.14.1.1<br>Section 13.1.2.3. | 1. Has an operating and emergency procedure for the safe use of the Analytical X-ray Equipment or Scanning Electron Microscope been developed and maintained? (Command operating and emergency procedures for electron microscopes and closed system analytical equipment that requires a vacuum to operate shall be developed and written by the command's subject matter expert and authorized users and shall be approved by the RSO.) | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.14.1.3<br>Section 13.1.2.3  | 2. Has the operating and emergency procedures been reviewed and approved by the command RSO?                                                                                                                                                                                                                                                                                                                                              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

| Reference (a)                        | Item                                                                                                                                                                                         | Yes                      | No                       | N/A                      | Comment |
|--------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 2.14.1.4<br>Section 13.1.2.1 | 3. Are the operating and emergency procedures part of a command level instruction or part of a command endorsed RASP instruction?                                                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 2.14.1.7                     | 4. Do operating procedures incorporate the specific procedures and processes required by the command to safely use the device, and are not a reprint of the manufacturer's operating manual? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 13.1.2.4                     | 5. Is a copy of the procedures present at the control console?                                                                                                                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 13.4.2.5                     | 6. Are routine operations prohibited when shields are removed or cabinet doors are open?                                                                                                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 13.4.2.6                     | 7. Is the installation, alignment, or operation of non-standard accessories prohibited until inspected and approved, in writing, by the RSO?                                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 13.4.2.7                     | 8. Are operations suspended and the RSO notified when any unusual operating conditions or suspected deficiencies are noted?                                                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

**Table D-38 - Analytical X-ray Equipment and Scanning Electron Microscope – Security and Labeling.**

| Reference (a)    | Item                                                                                                                                                                                                  | Yes                      | No                       | N/A                      | Comment |
|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 13.4.2.1 | 1. Are all meters, lights, indicators and user controls on the scanning electron microscope clearly labeled?                                                                                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 13.4.2.2 | 2. Is a standard radiation warning sign permanently affixed to the external surface of the scanning electron microscope with a label stating Caution-Produces X-ray When On" or words to that effect? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

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| Reference (a)    | Item                                                                                                                                                                                                                      | Yes                      | No                       | N/A                      | Comment |
|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 13.4.2.3 | 3. Is the control panel equipped with a removable key operated power switch, password protection system or contained within a locked room such that only authorized users have access to the keys, key card, or password? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

**Table D-39 - Analytical X-ray Equipment and Scanning Electron Microscope – Training.**

| Reference (a)                                          | Item                                                                                                                                                                                                                      | Yes                      | No                       | N/A                      | Comment |
|--------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 2.8.6.3<br>Section 2.8.6.4<br>Section 13.1.3.1 | 1. Do personnel that use Analytical X-ray Equipment or Scanning Electron Microscopes receive training as non-radiation workers upon initial assignment and annually thereafter that covers at least the following topics? |                          |                          |                          |         |
|                                                        | a. Sources of radiation in areas they may frequent.                                                                                                                                                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                                                        | b. Potential hazards associated with radiation sources in areas they may enter.                                                                                                                                           | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                                                        | c. Biological effects and risks associated with exposure to ionizing radiation from internal or external sources.                                                                                                         | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                                                        | d. Use and meaning of radiation warning signs and barriers.                                                                                                                                                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                                                        | e. Procedures to avoid and reduce radiation exposures.                                                                                                                                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                                                        | f. Personnel dosimetry, bioassay and/or internal monitoring requirements.                                                                                                                                                 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                                                        | g. Biological effects of exposure to the embryo/fetus if the person will receive greater than 100 mrem per year.                                                                                                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
|                                                        | h. Each individual is responsible for tracking his/her own radiation exposure and exposure reports that are provided by the command.                                                                                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

| Reference (a)    | Item                                                                                                                                                                                                                                                                                                   | Yes                      | No                       | N/A                      | Comment |
|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 13.1.3.3 | 2. Are personnel that operate or maintain electron microscopes receiving s initial training and demonstrating competence in identification of equipment radiation hazards, operating and emergency procedures, warning system, safety precautions, and reporting of actual or suspected overexposures? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

**Table D-40 - Research Accelerator - General Requirements.**

| Reference (a)    | Item                                                                                                                                                                            | Yes                      | No                       | N/A                      | Comment |
|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 12.1.2.1 | 1. Are written operating and emergency procedures established per Section 2.14 and reviewed annually by the RSO, accelerator operator(s), supervisors, and facility management? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 12.1.2.3 | 2. Did the accelerator operator secure operations if unable to comply with a procedural requirement or if an unsafe condition is indicated?                                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 12.1.4.1 | 3. Do radiation levels in unrestricted areas not exceed an instantaneous dose rate of 2 mrem/hr (0.02 mSv/hr)?                                                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

**Table D-41 - Research Accelerator - Additional Training Requirements.**

| Reference (a)    | Item                                                                                                                                                                                                   | Yes                      | No                       | N/A                      | Comment |
|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 12.1.3.2 | 1. Are Accelerator authorized users trained as radiation workers per Section 2.8.4?                                                                                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 12.1.3.3 | 2. Are accelerator authorized users trained on the use of any instruments required to perform surveys in accordance with operating procedures and was this training verified by practical examination? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

**Table D-42 - Research Accelerator - Control and Interlock System Requirements.**

| <b>Reference (a)</b> | <b>Item</b>                                                                                                                                                                                        | <b>Yes</b>               | <b>No</b>                | <b>N/A</b>               | <b>Comment</b> |
|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|----------------|
| Section 12.1.5.1     | 1. Are accelerator instrumentation and controls on the control console clearly identified and easily discernible?                                                                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                |
| Section 12.1.5.2     | 2. Are primary controls governing the operation of the accelerator capable of being locked?                                                                                                        | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                |
|                      | 3. Are the accelerator interlocks designed to meet the requirements:                                                                                                                               |                          |                          |                          |                |
| Section 12.1.5.3     | a. Each entrance into an exposure room or other high radiation areas shall be equipped with a barrier and an interlock that shuts down the machine when opened.                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                |
| Section 12.1.5.4     | b. Each interlock shall be on a circuit, which is independent of all other interlocks.                                                                                                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                |
| Section 12.1.5.5     | c. All interlocks shall be designed so that any defect or component failure in its system prevents operation of the accelerator.                                                                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                |
| Section 12.1.5.6     | d. When an interlock has been tripped, it shall only be possible to restart the accelerator by manually resetting controls first at the position of the trip and last at the main control console. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                |
| Section 12.1.5.7     | e. Interlocks and access controls shall not prevent an individual from leaving a high radiation area.                                                                                              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                |
| Section 12.1.5.8     | f. Operation of the accelerator shall not be possible unless all interlocks are closed.                                                                                                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                |
| Section 12.1.5.9     | g. All emergency power cutoff switches shall include a manual reset at the site where it was activated. The function of all switches shall be clearly marked.                                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                |

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**Table D-43 - Research Accelerator - Warning Devices and Area Radiation Monitor Requirements.**

| Reference (a)    | Item                                                                                                                                                                                                                                                                                          | Yes                      | No                       | N/A                      | Comment |
|------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 12.1.6.1 | 1. Is each location designated as a high radiation area and each entrance to that location equipped with easily observable warning lights (flashing or rotating) that operate when, and only when, radiation is being produced?                                                               | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 12.1.6.2 | 2. Does each accessible high radiation area have an audible warning device, which activates for at least 20 seconds prior to the possible creation of the high radiation area?                                                                                                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 12.1.6.4 | 3. Are all access barriers and pathways leading to high radiation areas posted as "Caution - Entering High Radiation Area?"                                                                                                                                                                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 12.1.6.5 | 4. During operation of the accelerator, are radiation levels in all high radiation areas continuously remotely monitored? (Note: The monitoring devices shall be electrically separate from the accelerator control and safety interlock systems and provide a readout at the control panel.) | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 12.1.6.6 | 5. Are area monitors calibrated at intervals not to exceed three years and after each servicing and repair?                                                                                                                                                                                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

**Table D-44 - Research Accelerator - Operational Requirements.**

| Reference (a)    | Item                                                                                | Yes                      | No                       | N/A                      | Comment |
|------------------|-------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 12.1.7.1 | 1. Is the accelerator secured to prevent unauthorized use when not in operation?    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 12.1.7.2 | 2. Is the interlock system only used to secure the machine in emergency situations? | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

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| Reference (a)    | Item                                                                                                                                                                                                                                                                                                                | Yes                      | No                       | N/A                      | Comment |
|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|---------|
| Section 12.1.7.3 | <p>3. Are all safety and warning devices, including interlocks, examined and tested by a qualified individual for proper operation at intervals not to exceed six months.</p> <p>Note: Records of such tests and maintenance shall be maintained at the accelerator facility for inspection by NAVSEA DET RASO.</p> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 12.1.7.4 | 4. Are safety and warning devices, including interlocks, checked for proper operation by the operator prior to each day of use and results recorded and initiated in the operator log?                                                                                                                              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 12.1.7.7 | 5. Is a copy of the current operating and emergency procedures at the accelerator control panel?                                                                                                                                                                                                                    | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |
| Section 12.1.7.8 | 6. Prior to startup, did the operator make a personal, complete visual inspection of all high radiation areas and restricted areas, to assure all personnel have left the area?                                                                                                                                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |         |

**Table D-45 - Summary of Radiation Protection Audit.**

| <b>Radiation Protection Audit Remarks</b>                                                       |  |        |  |
|-------------------------------------------------------------------------------------------------|--|--------|--|
|                                                                                                 |  |        |  |
| <b>Audit Results</b>                                                                            |  |        |  |
| Audit Evaluation: <input type="checkbox"/> Satisfactory <input type="checkbox"/> Unsatisfactory |  |        |  |
| Action Required: <input type="checkbox"/> Yes <input type="checkbox"/> No                       |  |        |  |
| <b>If action required, list relevant RDRs:</b>                                                  |  |        |  |
|                                                                                                 |  |        |  |
| <b>Review and Signatures</b>                                                                    |  |        |  |
| Name of Auditor:                                                                                |  | Title: |  |
| Signature of Auditor:                                                                           |  | Date:  |  |
| Name of Reviewer:                                                                               |  | Title: |  |
| Signature of Reviewer:                                                                          |  | Date:  |  |

Next Audit Due: \_\_\_\_\_

Appendix E  
USNA RASP Emergency Plan (Example)

1. **Summary.** Per reference (a), the USNA Emergency Plan should be established, reviewed annually, and updated as needed to the changing environments of our radiological laboratories. In addition, the USNA Emergency plan is required to be posted on the main entrances to all USNA radiological laboratories.

The USNA RASP has established that the Emergency Plan will encompass the immediate response of personnel to emergencies in the radiological laboratories. It is key that the (A)RSO and Laboratory Manager should be immediately notified once an incident is identified.

2. **Instruction(s).**

a. Open the “USNA RASP Emergency Plan”.

b. Review the USNA RASP Emergency Plan. The review should encompass whether the radiological incidents listed in section 4 encompass the primary responses requires at USNA.

(1) Cover Sheet with contact information and locations of RAM and Machine Sources.

(2) Section A: Fire, Explosions, and Emergency Related Incidents.

(3) Section B: Exposure Related Incidents.

(4) Section C: Contamination, Spill, Discharge, and Disposal Related Incidents.

(5) Section D: Airborne Related Incidents.

(6) Section E: Theft or Loss of Radioactive Material or Ionizing Radiation Producing Machine Incidents.

(7) Section F: Leaking Sealed Source.

(8) Section G. Equipment Failure and Misuse Incidents.

c. Update sections as appropriate.

d. Review Process: (estimate 4 - 5 weeks)

(1) The Radiation Safety Office will review, date, and share the plan to the RSC chair. (est. 1 week)

(2) RSC will review the plan. Upon completion, the RSC chair will date, and share the plan with the Radiation Safety Office. (est. 3 weeks)

(3) The Radiation Safety Office will perform a final review. (est. 1 week)

e. The Emergency plan will include an annual date to document RSC Review and be shared with all Laboratory Managers to post on the doors of the Radiological Laboratories.

**3. Best Practice(s):**

a. Update the Emergency Plan as items change, instruments return to operational status, or RAM moves.

b. Give yourself enough time to complete a thorough review. Begin the process 6 weeks before the annual deadline.

# USNA RASP Emergency Plan

The **purpose** of this document is to provide personnel with important information to facilitate a quick and efficient response to any emergency situation in one of the USNA RASP Radiological Laboratories.

This document is an extension of USNAINST 5104.2B: Radiological Safety Program (CHAPTER 11).

The USNA RASP Emergency Plan is subdivided into the following **Radiological Incidents and Emergency Planning**.

A. Fire, Explosions, and Emergency Related Incidents.

B. Exposure Related Incidents.

C. Contamination, Spill, Discharge and Disposal Related Incidents.\*

D. Airborne Related Incidents.

E. Theft or Loss of Radioactive Material or Ionizing Radiation Producing Machine Incidents.\*\*

F. Leaking Sealed Source.

G. Equipment Failure and Misuse Incidents.

*\*USNA does not currently possess ANY unsealed radioactive materials.*

*\*\*USNA does not currently possess ANY CAT 1 or CAT 2 materials.*

**In the event of a radiological incident, operations shall not resume without written consent by the USNA RSC and Radiation Safety Office.**

## 1. General Contact Information for Radiation Safety Office and Naval Academy Duty Officer.

| Name                                                                                                                        | Title                              | Number           | Hours                    |
|-----------------------------------------------------------------------------------------------------------------------------|------------------------------------|------------------|--------------------------|
|                                                                                                                             | Radiation Safety Officer           |                  | Working hours:           |
|                                                                                                                             | Assistant Radiation Safety Officer |                  |                          |
|                                                                                                                             | RSC Chair                          |                  |                          |
| Naval Academy Duty Officer (NADO)                                                                                           |                                    | 443 – 569 – 2180 | Outside of working hours |
| USNA Security and Fire                                                                                                      |                                    | 410 – 293 – 3333 | As needed                |
| <i>RSC Chair should be contacted in the event the (Assistant) Radiation Safety Officer cannot be immediately contacted.</i> |                                    |                  |                          |
| <i>***USNA RASP Emergency Contact List is available at the entrance to every Radiological Facility.</i>                     |                                    |                  |                          |

## 2. Locations of Radioactive Materials at USNA (Building, Location, Material(s) Stored).

| Building  | Location       | Material(s)                                            |
|-----------|----------------|--------------------------------------------------------|
| Chauvenet | CH-028         | Physics RAM                                            |
| Hopper    | HP-407A (CERF) | Special Nuclear Material of Low Strategic Significance |
| Michelson | MI-032         | Chemistry RAM                                          |
| Rickover  | RI-71          | SCR                                                    |
|           | RI-73          | Nucleonics RAM (as needed)                             |
|           | RI-75A         | Nucleonics RAM                                         |

## 3. Locations of Machine Sources of Radiation at USNA (Building, Location, Machine Source).

| Building  | Location | Machine Source                                                                  |
|-----------|----------|---------------------------------------------------------------------------------|
| Chauvenet | CH-029   | Electrostatic Particle Accelerator                                              |
|           | CH-044   | PANalytical X-Ray Diffractometer                                                |
|           | CH-046   | PHYWE XR 4.0 X-Ray Diffractometer, JEOL JSM-6010LA Scanning Electron Microscope |
| Michelson | MI-036   | M4 TORNADO XRF Spectrometer                                                     |
|           | MI-131   | RIGAKU XtaLab Synergy-I X-Ray Diffractometer                                    |
| Rickover  | RI-73    | Neutron Generators D-711 and MP320                                              |
|           | RI-237A  | TESCAN Scanning Electron Microscope                                             |

Date of USNA RSC Review: \_\_\_\_\_

## A. Fire, Explosions, and emergency related incidents.

(1) **Fire in Radioactive Material Storage Area.** The radioactive sources used are either small and pose little radiological threat and/or are of a “sealed” design where the casing will prevent the release of the RAM in most cases. Externally, they pose little danger and should not be a concern during firefighting. The primary danger in a fire is that if the source is damaged the radioactive material from the source can become airborne and enough of it could be ingested or inhaled into the body to cause harm. Extinguishing the fire should be the main priority, but a precaution when dealing with a fire involving these labs is to use a forced air breathing device.

- (a) Alert personnel in the area and ensure the fire department and (A)RSO are contacted.
- (b) If safe to do so, remove radioactive sources from the area of concern (concern is melting sources).
- (c) If safe to do so, attempt to utilize a fire extinguisher to put out flames.
- (d) If the fire does not extinguish, evacuate as necessary.
- (e) Inform the chain of command:

- 1. Laboratory Manager
- 2. Radiation Safety Officer
- 3. Assistant Radiation Safety Officer
- 4. Building and Facility Duty Officer
- 5. Outside of Working Hours - NADO

(2) **Fire in area with Machine Sources.** These devices are protected with interlocks and require electrical power to produce radiation. These devices pose no radiological threat if de-energized.

- (a) Alert personnel in the area and ensure the fire department and (A)RSO are contacted.
- (b) Secure power to the machine, if applicable.
- (c) If safe to do so, attempt to utilize a fire extinguisher to put out flames.
- (d) If the fire does not extinguish, evacuate as necessary.
- (e) Inform the chain of command:

- 1. Laboratory Manager
- 2. Radiation Safety Officer
- 3. Assistant Radiation Safety Officer
- 4. Building and Facility Duty Officer
- 5. Outside of Working Hours - NADO

(3) **Explosions.** In the event of an explosion, personnel shall immediately

- (a) Evacuate the area.
- (b) Inform the chain of command.

- 1. Laboratory Manager
- 2. Radiation Safety Officer
- 3. Assistant Radiation Safety Officer
- 4. Building and Facility Duty Officer
- 5. Outside of Working Hours - NADO

(4) **Medical Emergency** (Injury in radiological laboratory). Further guidance on the medical management of radiological injuries is provided in BUMEDINST 6470.10 (series).

- (a) General Medical Emergency.

1. Any medical emergency sustained in a posted radiological area shall be reported IMMEDIATELY to the (A)RSO and evaluated by a medical department representative or medical officer/physician.

- (b) Medical Emergency resulting in open wound.

1. Any injury that results in an open wound in a radiological area that has the potential to be contaminated shall be reported IMMEDIATELY to the (A)RSO and evaluated by a medical department representative or medical officer/physician.

2. The (A)RSO shall report the injury and resultant actions to NAVSEA DET RASO and document the event and surveys performed.

## B. Exposure Related Incidents.

(1) **EPD Alarms.** If an EPD has a high dose alarm, screen failure, faulty buttons, or error codes:

- (a) Secure operations.
- (b) Immediately exit the operations area.
- (c) Request that other workers in the immediate work area read their EPDS to determine if they are reading abnormally high.
- (d) Notify the (A)RSO who will coordinate the performance of a dose investigation and provide a dose estimate.
- (e) Surrender the primary dosimeter for processing.

(2) In the event that

- (a) Radiation dose to individual of general public greater than 2 mrem/hr in a year
- (b) External radiation dose in excess of limits (Table 4)
- (c) Unauthorized or accidental entry of personnel into a (high) radiation area where person(s) receive excess of 2 mR
- (d) Entry into a high radiation area without the required dosimetric devices and one mrem or more of exposure is received

1. Immediately secure operations.

2. Inform the chain of command:

a. Laboratory Manager

b. Radiation Safety Officer

c. Assistant Radiation Safety Officer

3. Report incident to NAVSEA DET RASO by Radiation Safety Office.

**Table 4.** Summary of RASP Dose Limits and ACLs.

| Description of Dose Type                                                                        | RASP Limit    |                | RASP Administrative Control Level (ACL) |              |
|-------------------------------------------------------------------------------------------------|---------------|----------------|-----------------------------------------|--------------|
| Total Effective Dose Equivalent (Whole Body)                                                    | 3.0 rem/qtr   | 0.03 Sv/qtr    | N/A                                     |              |
| Total Effective Dose Equivalent (Whole Body)                                                    | 5.0 rem/yr    | 0.05 Sv/yr     | 0.5 rem/yr                              | 0.005 Sv/yr  |
| Shallow Dose Equivalent (Extremities)                                                           | 50.0 rem/yr   | 0.5 Sv/yr      | 5.0 rem/yr                              | 0.05 Sv/yr   |
| Shallow Dose Equivalent (Skin)                                                                  | 50.0 rem/yr   | 0.5 Sv/yr      | 5.0 rem/yr                              | 0.05 Sv/yr   |
| Eye Dose Equivalent (Eyes)                                                                      | 15.0 rem/yr   | 0.15 Sv/yr     | 1.5 rem/yr                              | 0.015 Sv/yr  |
| Sum of Deep Dose Equivalent for any organ or tissue other than the lens of the eye (Organ Dose) | 50.0 rem/yr   | 0.5 Sv/yr      | 5.0 rem/yr                              | 0.05 Sv/yr   |
| Non-Radiation Workers (Whole Body)                                                              | 0.5 rem/yr    | 0.005 Sv/yr    | 0.1 rem/yr                              | 0.001 Sv/yr  |
| Embryo/Fetus (Declared Pregnant Worker)                                                         | 0.5 rem total | 0.005 Sv total | 0.05 rem/mo                             | 0.0005 Sv/mo |
| Minors (Occupationally exposed)                                                                 | 0.5 rem/yr    | 0.005 Sv/yr    | 0.1 rem/yr                              | 0.001 Sv/yr  |
| Members of Public                                                                               | 0.1 rem/yr    | 0.001 Sv/yr    | N/A                                     |              |

## C. Contamination, spill, discharge, and disposal related incidents.

*\*USNA does not currently possess ANY unsealed radioactive materials.*

### (1) Small Spills of non-volatile radioactive liquids (less than 5 Liters, less than 1 mCi of activity).

- (a) Stop the spill. Ensure that the source of the spill has been corrected.
- (b) Warn others of the risk. Alert personnel in the area and ensure the Laboratory Manager and (A)RSO are contacted.
- (c) Isolate the area to minimize contamination to other areas. Use barriers as appropriate.
- (d) Minimize Exposure. Use principles of ALARA (time, distance, shielding) to minimize exposure to the spill.
- (e) From a safe distance, maintain positive control of the affected area until the Laboratory Manager or (A)RSO arrives.

*The Laboratory Manager and/or (A)RSO will take the following steps as appropriate:*

- (a) Obtain PPE, including if necessary, protective shoe covers.
- (b) Mark the perimeter of the spill and cover with absorbent paper (or pads).
- (c) Use absorbent material to clean the spill starting from the perimeter working inward. Carefully, place these pads in a trash bag (double bag) and label as Radioactive Waste.
- (d) Continue covering the spill with absorbent paper until all free liquid has been absorbed. Place all materials in the labeled trash bag.
- (e) Survey the area of the spill to determine the extent of activity. Take swipes as necessary.
- (f) Survey the trash bag full of absorbent materials to determine the extent of activity. Take swipes as necessary.
- (g) The spill is considered clean when radioactivity can no longer be detected in the affected area by direct frisk and when the measurements made of the paper towels reveal that there is no longer any removable activity.
- (h) When decontamination is finished, place into the plastic waste bag, seal it, and label it with a radioactive material warning sticker. Add all clean up materials to LLRW inventory and properly store them in low level radioactive waste (LLRW).
- (i) The (A)RSO shall confirm that decontamination is complete, monitor individuals for personal contamination, and contact the Radiation Health Officer to determine if bioassay monitoring of individuals involved is merited.

### (2) Large spills of non-volatile radioactive liquids (greater than 5 Liters, more than 1 mCi of activity).

- (a) Stop the spill. Ensure that the source of the spill has been corrected.
- (b) Warn others of the risk. Alert personnel in the area and ensure the Laboratory Manager and (A)RSO are contacted.
- (c) Isolate the area to minimize contamination to other areas. Use barriers as appropriate.
- (d) Minimize Exposure. Use principles of ALARA (time, distance, shielding) to minimize exposure to the spill.
- (f) From a safe distance, maintain positive control of the affected area until the (A)RSO arrives.
- (g) Follow the directions of the (A)RSO.
- (h) The (A)RSO shall confirm that decontamination is complete, monitor individuals for personal contamination, and contact the Radiation Health Officer to determine if bioassay monitoring of individuals involved is merited.

### (3) Skin Contamination (Nucleonics Laboratory).

- (a) Alert the nearest person to contact:

1. Laboratory Manager.
2. Radiation Safety Officer.
3. Assistant Radiation Safety Officer.

a. The (A)RSO will request support from medical department representative or medical officer/physician for evaluation of individual.

- (b) Immediately begin decontamination at the nearest sink in the laboratory.

1. Use mild soap and water - wash the affected area two or three times, but no more.
2. Be careful not to spread localized contamination. Strenuous scrubbing will abrade the skin, leading to increased penetration of the contaminant.

(c) If hair becomes contaminated, immediately begin washing with soap and water. Avoid spreading contamination to other parts of the head.

## C. Contamination, spill, discharge, and disposal related incidents.

(d) If contamination of the eyes occurs, flush with copious amounts of isotonic solution (if available), otherwise, use water. Be sure to roll back the eyelid as far as possible. If residual contamination remains, further decontamination shall be required under medical supervision.

(e) If contamination of nose or mouth occurs, immediately flush with copious amounts of water. Be careful not to ingest the rinse.

### (4) Contamination of Clothing.

(a) Contact the chain of command:

1. Laboratory Manager
2. Radiation Safety Officer
3. Assistant Radiation Safety Officer

(b) Follow the directions of the (A)RSO.

1. The (A)RSO will provide appropriate alternate clothing options including surgical scrubs and surgical booties.
2. Change out of affected clothing being careful not to contaminate your skin.
3. Place affected clothing in plastic bag, label with a radioactive material warning sticker, and transfer to the Radiation Safety Office for decontamination.

(c) The (A)RSO shall confirm that decontamination is complete, monitor individuals for personal contamination, and contact the Radiation Health Officer to determine if bioassay monitoring of individuals involved is merited.

### (5) In the event that **Radioactive material is released to the environment above effluent limits or unauthorized disposal of radioactive material has been performed:**

- (a) Immediately secure operations.
- (b) Inform the chain of command:

1. Laboratory Manager
2. Radiation Safety Officer
3. Assistant Radiation Safety Officer

(c) Report incident to NAVSEA DET RASO by Radiation Safety Office.

### (6) Contaminated Packages. If received packages measure contamination or radiation levels in excess of 10 CFR 71:

- (a) Immediately secure the area.
- (b) Inform the chain of command:

1. Laboratory Manager
2. Radiation Safety Officer
3. Assistant Radiation Safety Officer

(c) Report incident to NAVSEA DET RASO by Radiation Safety Office.

(7) In the event that ANY contamination event occurs **outside of controlled areas:** (controlled areas = RSC approved areas for use of radiological materials or ionizing radiation producing machines).

- (a) Immediately secure the area.
- (b) Inform the chain of command:

1. Laboratory Manager
2. Radiation Safety Officer
3. Assistant Radiation Safety Officer

### **C. Contamination, spill, discharge, and disposal related incidents.**

(c) If safe to do so, remain in the area to warn general public to stay away from the area until a member of the Radiation Safety Office arrives.

(d) Report incident to NAVSEA DET RASO by Radiation Safety Office.

## D. Airborne related incidents.

### (1) Release of Airborne or Volatile Radioactivity (Nucleonics Laboratory).

(a) Alert everyone in the area of the situation and advise them to evacuate the room, and to remain in the area outside the room. Assign someone to contact the (A)RSO.

- 1. Radiation Safety Officer
- 2. Assistant Radiation Safety Officer

- (b) If possible, stop the release of airborne radioactivity from the source, but do not inhale.
- (c) Evacuate the room, closing the door behind you.
- (d) Stand guard to prevent further entry until the (A)RSO arrives.
- (e) Follow the directions of the (A)RSO.

1. If contamination is obvious, do not wait for the arrival of the (A)RSO or a designee but immediately commence personal decontamination at the nearest sink.

(f) The (A)RSO shall confirm that decontamination is complete, monitor individuals for personal contamination, and contact the Radiation Health Officer to determine if bioassay monitoring of individuals involved is merited.

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**Note:** The highest risk of airborne radioactivity is in the Neutron Generator Facility in RI-73, which is a restricted area. It will be the responsibility of the (A)RSO to determine if an individual member of the public may have received a dose equivalent in excess of 10 mrem (0.1 mSv) per year from air emissions. The external air vent for this facility is on the Rickover Terrace (not easily accessible by the public).

## E. Theft or loss of radioactive material or ionizing radiation producing machine incidents.

*\*USNA does not currently possess ANY CAT 1 or CAT 2 materials. Our materials fall well below the limits.*

### (1) Loss or theft of Radiological Affairs Support Program (RASP) material.

- (a) If it is a known theft, contact the (A)RSO, Security (*ext. 3 – 3333*), and inform the chain of command immediately.
- (b) Secure the area and stand guard until the (A)RSO or security arrives.
- (c) Search the area and check applicable source utilization logs.
- (d) Conduct a full inventory of sources to ensure additional sources were not lost or stolen.
- (e) The (A)RSO will inform NAVSEA DET RASO of any lost or stolen sources.

(2) **Loss of Security.** A loss of security is any instance where one of the applicable USNA Security controls is no longer maintained. **(Examples might include** Unauthorized personnel in laboratory, Loss of positive key control, Machine Source computer left unlocked while instrument is running, etc.)

(a) Secure the area. It is the responsibility of the identifying personnel to maintain positive control over the area in the event security is lost. Identify where security was lost and correct as needed as long as it is safe to do so.

(b) Notify the Laboratory Manager and RSO. The Laboratory Manager should be immediately notified in the event security is lost. The Radiation Safety Officer (and Radiation Safety Office) must also be notified. The Radiation Safety Office will typically respond to the event to provide support to secure the area.

(c) Report and Assess. A RASP Deficiency Report (RDR) should be submitted to report the incident for the record. An USNA RASP Radiological Incident Report should be completed to document the event (supplemental information to support the RDR). The Radiation Safety Office along with the Laboratory Manager will assess the incident to understand how to mitigate the incident in the future.

(3) **Lost Shipment.** *\*High priority shipments (White I, Yellow II, Yellow III, etc) are all handled by the Radiation Safety Office directly.* In the event a shipment is identified to be lost, the originator (or receiver) shall:

- (a) Identify if the shipment was delivered to USNA.
- (b) (If the shipment was not delivered to USNA) Communicate with the vendor to track down the shipment.

## F. Leaking sealed source.

### (1) Leaking Sealed Radioactive Source.

(a) Frisk check of swipe with AN/PDQ-4 results in a reading 100 cpm greater than background:

1. Individuals will immediately report to the (A)RSO.

a. Radiation Safety Officer

b. Assistant Radiation Safety Officer

2. The swipe should be placed on the absorbent pad, secondary barrier, separate from all other swipes.

3. The individual who performed the swipe should immediately check if contamination is also detected on the gloves.

4. Follow the guidance of the (A)RSO.

(b) Frisk check of gloves with AN/PDQ-4 results in a reading 100 cpm greater than background.

1. Individual will immediately report to the (A)RSO.

a. Radiation Safety Officer

b. Assistant Radiation Safety Officer

2. The individual with the contaminated gloves should carefully remove the gloves and place them on the absorbent pad.

3. Re-frisk your hands to confirm that contamination has not spread to the hands.

4. If the result confirms contamination, wash the hands thoroughly.

5. Re-frisk your hands to determine if contamination remains.

6. If the result confirms contamination, ask a secondary individual to perform a thorough frisk of the arms of the individual.

7. Follow the guidance of the (A)RSO.

(c) If a leak test indicates the presence of 0.005 microcuries (185 Bq) or more of removable contamination:

1. Immediately inform the (A)RSO.

a. Radiation Safety Officer

b. Assistant Radiation Safety Officer

2. The (A)RSO will notify NAVSEA DET RASO and inform the chain of command.

3. Any leaking source should be removed from service and placed in an appropriate storage container.

4. The Radiation Safety Office will begin an investigation to understand the circumstances associated with source leakage.

## G. Equipment failure and misuse incidents.

(1) **Equipment is disabled or fails to function as designed.** In the event a machine source fails to operate as approved:

- (a) Power off the instrument.
- (b) Secure the instrument and area.
- (c) Inform the chain of command:

- 1. Laboratory Manager
- 2. Radiation Safety Officer
- 3. Assistant Radiation Safety Officer

(2) Failure of safety devices to function properly such as an interlock not terminating exposure.

- (a) Power off the instrument.
- (b) Secure the instrument and area.
- (c) Inform the chain of command:

- 1. Laboratory Manager
- 2. Radiation Safety Officer
- 3. Assistant Radiation Safety Officer

**Reference:** Department of the Navy Sea Systems Command. *Radiological Affairs Support Program Manual*; NAVSEA S0420-AA-RAD-010 Revision 2A with ACN 1; Washington D.C., 2019.

**Section 2.14. Operating and Emergency Procedures (p 2 – 37)**

**2.14.1 General Requirements**

1. Commands shall develop and maintain operating and emergency procedures for the safe use of RASP radioactive material and radiation producing machines and devices.
2. Command operating and emergency procedures shall be developed and written by the command's subject matter expert and users and operators of the radioactive material or radiation producing machines and devices.
3. The operating and emergency procedures shall be reviewed and approved by the command RSO.
4. The operating and emergency procedures shall be a command level instruction or part of a command endorsed RASP instruction.
5. Each revision to an operating and emergency procedure shall be subject to the same approval process as the original.
6. If the command possesses a NRMP, revisions or changes shall be submitted as a NRMP amendment request per Section 3.2.3.
7. Operating procedures shall not be a reprint of the manufacturer's operating manual. They shall incorporate the specific procedures and processes required by the command to safely use the device.

**Section 2.14.2 Specific Requirements (p 2 – 38)**

1. As appropriate, operating and emergency procedures shall:
  - a. Be specific to each RASP operation, each piece of equipment, and facility/location. Use of portable equipment at multiple temporary sites outside a permanent facility constitutes one location.
  - b. Specify requirements for the use of primary and secondary dosimeters as required.
  - c. Specify requirements for engineered controls and equipment.
  - d. Specify contamination controls to be used when working with unsealed radioactive material.
  - e. Specify requirements for radiation protection surveys necessary to ensure RASP operations are conducted safely to include any special instrumentation and airborne monitoring for radioactivity.
  - f. Specify requirements for checking safety features such as lights, alarms, and interlocks.
  - g. Specify the personal qualifications required to perform the operation, and if applicable, internal monitoring required when working with unsealed radioactive material.
  - h. Specify and provide representative examples of all logs, records, and forms required to support each operation.
  - i. Include or reference another document that has current and accurate information on persons to be notified in the event of a radiological incident, and specify the method of notification.
  - j. Specify procedures to use in case of a radiological incident, including, shutting down the affected equipment and securing the area.
  - k. Specify that the RSO or ARSO shall be able to respond to an on-site radiological incident within the time required for normal commuting (<2 hours) to the command for RASP operations to take place.
2. Operating and emergency procedures shall be created and maintained per Section 2.26.14.

**Section 2.26.14 Operating and Emergency Procedures Records (p 2 – 82)**

1. Activities shall follow current SECNAV, OPNAV, SYSCOM and Type Commander requirements for generating local instructions.
2. Electronic or paper copies of operating and emergency procedure records shall be maintained indefinitely.