

Department of the Army  
Pamphlet 385-24

Safety

# The Army Radiation Safety Program

Headquarters  
Department of the Army  
Washington, DC  
30 November 2015

**UNCLASSIFIED**

# ***SUMMARY of CHANGE***

DA PAM 385-24  
The Army Radiation Safety Program

This major revision, dated 30 November 2015--

- o Adds a section for Inspector General inspections and audits (chap 1).
- o Clarifies the Laser Safety Program (chap 3).
- o Clarifies and expands guidance on the Electromagnetic Radiation Safety Program (chap 4).
- o Clarifies and expands guidance for radiofrequency safety training (para 7-4).
- o Clarifies enhanced security requirements for category 1 and 2 radioactive materials and aligns it with Part 37, Title 10, Code of Federal Regulations (chap 8).
- o Adds Decommissioning Activities (chap 9).

## Safety

# The Army Radiation Safety Program

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By Order of the Secretary of the Army:

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General, United States Army  
Chief of Staff

Official:



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Administrative Assistant to the  
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**History.** This publication is a major revision.

**Summary.** This pamphlet establishes Army radiation safety procedures. It provides guidance and direction to implement the safety requirements of AR 385–10 and other Federal regulations and laws. It provides guidance and direction to implement DODI 6055.08, DODI 6055.11, DODI 6055.15, and DODI 5000.69. It includes Army guidance for the use, licensing, transportation, disposal, dosimetry, accident reporting, safety design, accountability of, and radiation exposure standards for ionizing and non-ionizing radiation sources. This pamphlet addresses peacetime, deployment, redeployment, and wartime radiation

safety activities. This pamphlet does not apply to nuclear weapons surety (AR 50–5). Active Army, Army National Guard/Army National Guard of the United States, and U.S. Army Reserve personnel who violate this pamphlet are subject to punishment under the Uniform Code of Military Justice. Civilian and contractors are subject to applicable civil or criminal statutes.

**Applicability.** This pamphlet applies to the active Army, the Army National Guard/Army National Guard of the United States, and the U.S. Army Reserve, unless otherwise stated. It also applies to all active duty Army military personnel at any time, on or off a Department of Defense installation; all Army civilian personnel in a duty status, on or off a Department of Defense installation; all Army contractors; and all persons at any time on an Army installation.

**Proponent and exception authority.** The proponent of this pamphlet is the Director of the Army Staff. The proponent has the authority to approve exceptions or waivers to this pamphlet that are consistent with controlling law and regulations. The proponent may delegate this approval authority, in writing, to a division chief within the proponent agency or its direct reporting unit or field operating agency, in the grade of colonel or the civilian equivalent. Activities may request a waiver to

this regulation by providing justification that includes a full analysis of the expected benefits and must include formal review by the activity's senior legal officer. All waiver requests will be endorsed by the commander or senior leader of the requesting activity and forwarded through their higher headquarters to the policy proponent. Refer to AR 25–30 for specific guidance.

**Suggested improvements.** Users are invited to send comments and suggested improvements on DA Form 2028 (Recommended Changes to Publications and Blank Forms) directly to the Office of the Director of Army Safety (DACS–SF), 9351 Hall Road, Building 1456, Fort Belvoir, VA 22060–5860.

**Distribution.** This publication is available in electronic media only and is intended for command levels A, B, C, D, and E for active Army, the Army National Guard/Army National Guard of the United States, and the U.S. Army Reserve.

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## Contents (Listed by paragraph and page number)

### Chapter 1

Introduction, page 1

Purpose • 1–1, page 1

References • 1–2, page 1

Explanation of abbreviations and terms • 1–3, page 1

Functions • 1–4, page 1

Deviations • 1–5, page 8

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\*This pamphlet supersedes DA Pam 385–24, dated 22 September 2011.

## **Contents—Continued**

### **Chapter 2**

#### **Ionizing Radiation Safety, page 8**

Army Radiation Safety Program • 2-1, page 8

Radiation safety key components • 2-2, page 8

General • 2-3, page 9

Control measures • 2-4, page 9

Nuclear Regulatory Commission licenses • 2-5, page 10

Army radiation authorizations • 2-6, page 10

Army radiation permits • 2-7, page 11

Army radiation safety record keeping • 2-8, page 14

Training • 2-9, page 14

Personnel monitoring • 2-10, page 14

Life cycle management for radioactive commodities and radiation generating devices • 2-11, page 14

Inventory and accountability • 2-12, page 15

Use and storage • 2-13, page 15

Internal and external program reviews • 2-14, page 15

Equipment calibration • 2-15, page 15

Survey instruments • 2-16, page 15

Radiation surveys • 2-17, page 15

Shipping, receiving, transferring, and transport • 2-18, page 15

Personnel Security Screening System • 2-19, page 16

Cargo and Vehicle Security Screening System • 2-20, page 16

Emergency response • 2-21, page 16

Foreign and captured material • 2-22, page 16

Range maintenance and disposal • 2-23, page 16

Handling and disposal of unwanted radioactive material • 2-24, page 17

### **Chapter 3**

#### **Laser Safety, page 17**

General • 3-1, page 17

Military-exempt lasers • 3-2, page 18

Laser Safety Program • 3-3, page 18

### **Chapter 4**

#### **Electromagnetic Radiation Safety, page 19**

General • 4-1, page 19

Measurement and evaluation of electromagnetic field from 0 Hz to 300 GHz • 4-2, page 20

Electromagnetic field controls • 4-3, page 20

Duties of the Radio Frequency Safety Officer • 4-4, page 21

Siting of commercial telecommunications equipment on Army installations • 4-5, page 21

### **Chapter 5**

#### **Radiation Safety Standards, Area Designations, and Contamination Limits, page 22**

General • 5-1, page 22

Area designations • 5-2, page 22

Radioactive contamination • 5-3, page 22

### **Chapter 6**

#### **Special Reporting Requirements, page 24**

General • 6-1, page 24

Other required reporting agencies and time requirements • 6-2, page 25

Radiological Accident/incident Report • 6-3, page 26

## Contents—Continued

### Chapter 7

#### Training Requirements for Radiation Safety Officers, Laser Safety Officers, and Radiofrequency Safety Officers, *page 26*

General • 7-1, *page 26*

Radiation safety officer training requirements • 7-2, *page 26*

Laser safety training requirements • 7-3, *page 27*

Radiofrequency safety training requirements • 7-4, *page 28*

### Chapter 8

#### Enhanced Security Requirements for Radionuclides of Concern, *page 29*

General • 8-1, *page 29*

Radioactive Source Categories • 8-2, *page 29*

Unescorted access authorization • 8-3, *page 31*

Security of radionuclides of concerns • 8-4, *page 32*

### Chapter 9

#### Decommissioning of Facilities, *page 33*

General • 9-1, *page 33*

Classification for decommissioning purposes • 9-2, *page 33*

Procedure • 9-3, *page 33*

Typical process for areas that leave Army control • 9-4, *page 33*

Typical process for areas that will not leave Army control • 9-5, *page 35*

## Appendixes

A. References, *page 37*

B. Annual Radiation Safety Audit Checklist, *page 46*

## Table List

Table 5-1: Army personnel ionizing radiation exposure standards, *page 23*

Table 5-2: Electromagnetic radiation, *page 23*

Table 5-3: Screening levels for clearance, *page 24*

Table 6-1: Army Materiel Command Nuclear Regulatory Commission commodity license radiation safety officers, *page 25*

Table 8-1: Radionuclides of concern, *page 30*

## Figure List

Figure 2-1: Sample Army Radiation Permit, *page 13*

Figure 8-1: Unity rule for Category 2 sources, *page 31*

## Glossary



## Chapter 1 Introduction

### 1-1. Purpose

This pamphlet contains technical requirements for developing management and control processes for operations involving sources of radiation, and its implementation is necessary to meet the requirements of AR 385-10. Its objective is to ensure the safe use of radiation sources and compliance with all applicable Federal and Department of Defense (DOD) rules and regulations.

### 1-2. References

See appendix A.

### 1-3. Explanation of abbreviations and terms

See the glossary.

### 1-4. Functions

Based upon the responsibilities as defined in AR 385-10, the following organizations support radiation safety by providing the following functions:

- a. *Assistant Secretary of the Army (Installations Energy, and Environment)*. The ASA (IE&E)—
  - (1) Establishes overall Army environmental, safety, and occupational health policy that includes radiation safety.
  - (2) Maintains general oversight of, and serves as the advocate for, the ARSP and the Career Program 12 Safety and Occupational Health Program, which covers job series 1306 Health Physicists.
- b. *Assistant Secretary of the Army (Manpower and Reserve Affairs)*. The ASA (M&RA)—
  - (1) Establishes overall Army health and preventive medicine policy.
  - (2) Maintains oversight of medical and health aspects of the ARSP.
- c. *The Inspector General*. The IG—
  - (1) Conducts radiation safety inspections and license compliance audits of the ARSP.
  - (2) Establishes standard inspection policies, procedures, and techniques for the conduct of these inspections and audits to include periodic coordination and consultation with Headquarters, Department of the Army (HQDA) offices and Army organizations to help ensure a common understanding of regulations and guidance.
  - (3) Requests support from the Army staff and subordinate headquarters for the resources and expertise necessary to ensure accomplishment of the technical inspection mission.
- d. *Director of Army Safety, Office of the Chief of Staff, Army*. The DASAF—
  - (1) Chairs the Army Radiation Safety Council (ARSC) as the Army staff component providing oversight of the ARSP.
  - (2) Provides Army guidance and procedures to implement requirements of—
    - (a) Title 10, Code of Federal Regulations (10 CFR).
    - (b) 21 CFR Food and Drug Administration (FDA), that covers electronic products, to include x-ray systems, lasers, and electromagnetic radiation producing devices from 0 Hz to 300 GHz to include radio frequency (RF) systems:
    - (c) 29 CFR.
    - (d) 32 CFR 655.10.
    - (e) 40 CFR.
    - (f) 49 CFR.
    - (g) Department of Defense Instruction (DODI) 6055.08.
    - (h) DODI 6055.11.
    - (i) DODI 6055.15.
    - (j) DODI 5000.69.
  - (3) Administers, directs, and integrates risk management (RM) in accordance with AR 385-10, DA Pam 385-30, and ATP 5-19.
  - (4) Appoints in writing the Army Radiation Safety Officer (ARSO), the Army Laser Safety Officer, and the Army Radiofrequency Radiation Safety Officer.
- e. *Commanding General, U.S. Army Materiel Command*. The CG, AMC—
  - (1) Exercises administrative control over U.S. Nuclear Regulatory Commission (NRC) licenses and Army radiation authorizations (ARAs) for Army radioactive commodities within AMC's purview. This function is routinely managed by AMC major subordinate commands (MSCs). This includes, but is not limited to—
    - (a) Acquires, amends, and maintains NRC licensees for radioactive commodities.
    - (b) Exercises administrative control over licenses.
    - (c) Coordinates NRC license correspondence with applicable commands and the ARSO.

- (d) Ensures reporting license violations to the NRC by the appropriate subordinate command that is the NRC license holder in accordance with 10 CFR and notifying the ARSO.
- (e) Performs or coordinates license compliance audits for activities that use AMC-licensed radioactive commodities.
- (f) Coordinates with U.S. Army Training and Doctrine Command (TRADOC), U.S. Army Medical Command (MEDCOM), and applicable licensees to ensure training materials meet NRC license conditions.
- (2) Provides personnel dosimetry services through the Army Dosimetry Center (ADC). The Chief, ADC (in accordance with 10 CFR 20.1501(d), AR 385–10, DA Pam 385–25, and this pamphlet)—
- (a) Publishes instructions for starting, maintaining, and ending personnel dosimetry services.
- (b) Maintains the Army’s Central Dosimetry Records Repository (CDRR). The CDRR archives comprehensive dosimetry records for all Army personnel and for other personnel who use Army dosimetry services. Records must meet the requirements of 10 CFR 20.2106, 10 CFR 20.2110, and OSHA 1910.1096(b)(2)(iii). Records include results of bioassays, administrative dose assignments (including copies of documents that make the assignments), and supplementary occupational dose equivalent information (for example, dosimetry information resulting from off-duty employment) that radiation safety officers (RSOs) reports. In particular, the ADC must meet the requirements of 10 CFR 20.2106(f) for long-term retention of these records.
- (c) Provides personnel dosimetry records (automated dosimetry report) to RSOs for all personnel who received dosimetry services during the previous calendar quarter. These reports enable supported RSOs to meet all recordkeeping requirements in 10 CFR 20.2106.
- (d) Provides reporting services that enable RSOs to meet all requirements of 10 CFR 19.13, 29 CFR 1910.1096(n) and (o), and 29 CFR 1926.53.
- (e) Provides reporting services that meet the requirements of 10 CFR 20.2206.
- (f) Immediately notifies (by telephone or message) the RSO, the radiological hygiene consultant to The Surgeon General (TSG), the command Radiation Safety Staff Officer (RSSO), and the ARSO when dosimetry results indicate that any Army personnel ionizing radiation exposure standard (see table 5–1) may have been exceeded.
- (3) Provides Army low-level radioactive waste disposal services (by the Army Low-Level Radioactive Waste Disposal Division, U.S. Army Joint Munitions Command, Safety/Rad Waste Directorate, AMSJM–SF, Rock Island, IL 61299–6000). In addition—
- (a) Establishes procedures for implementing the Army’s responsibility as DOD lead agency for unwanted radioactive material disposal.
- (b) Maintains records of all Army radioactive waste disposal by burial or recycling.
- (4) Provides the Army radiation test, measurement, and diagnostic equipment program and accredited radiation instrument calibration services (see AR 750–43 and Technical Bulletin (TB) 750–25).
- (5) Assumes responsibility in the event of an NRC violation or radiation accident at a facility involving AMC-licensed radioactive materials (RAMs) that result in NRC Escalated Enforcement Action against an AMC commodity licensee, any resulting administrative civil penalty is shared between AMC and the responsible command as mutually agreed between their respective radiation safety offices, based on an evaluation of the nature of the alleged violations and penalty assessment.
- (6) Ensures that foreign military sales of RAM, items that contain RAM, radiation generating devices, and military-exempt lasers comply with applicable U.S. regulations and DOD directives.
- (7) Appoints, in writing, an AMC RSSO to help oversee the AMC Radiation Safety Program (RSP).
- (8) Resolves radiation issues among AMC commands as necessary.
- f. The Surgeon General. TSG—*
- (1) Approves and provides radiation dose limits and deviations to previously published dose (DA Pam 385–25 and AR 385–10) to the ARSO for promulgation as necessary (see para 1–4*m*(3)).
- (2) Provides Army staff supervision on the medical aspects of ionizing and non-ionizing radiation injury.
- g. Commanding General, U.S. Forces Command. The CG, FORSCOM—*
- (1) Ensures command compliance with conditions of NRC licenses and ARAs, including AMC-held radioactive commodity licenses (see para 2–1*b*). The CG should use a memorandum of agreement or similar mechanisms to clarify the relationship between the U.S. Army Headquarters (Army commands (ACOMs), Army service component commands (ASCCs), direct reporting units (DRUs), and the NRC license holder.
- (2) Designates, in writing, a trained RSSO.
- (3) Issues ARAs (see para 2–3).
- (4) Establishes and employs, as applicable, procedures to ensure that captured, purchased, borrowed, or otherwise obtained foreign equipment and materiel is surveyed for RAM and that appropriate actions are taken following discovery of any RAM in those items.
- (5) Maintains the RSP by:
- (a) Establishing review and approval procedures for integrating RM in accordance with AR 385–10, DA Pam 385–30 and ATP 5–19.
- (b) Ensuring, for programs under their purview, that each NRC license, Army reactor permit, ARA, and RSP is



reviewed annually and inspected periodically for compliance with applicable radiation safety and health regulations and guidance. These inspections should be performed at a frequency commensurate with the associated hazard, but not to exceed 3 years. These services may be provided by U.S. Army Public Health Command (USAPHC).

(6) Ensures a laser safety program is in place for the command and appoints a properly trained laser safety officer (LSO) in writing to manage the program. Maintain the Laser Safety Program by:

(a) Tracking DOD military-exempt lasers to ensure compliance with the FDA military exemption (FDA exemption no. 76EL-01DOD), proper disposal of DOD military exempt lasers that are not classified in the interest of national defense, and ensuring lasers are brought into compliance with the FDA regulations.

(b) Disposing unusable lasers or laser parts to the Defense Reutilization and Marketing Service for utilization screening within DOD (see DOD 4160.21-M-1).

(7) Ensures an electromagnetic radiation safety program is in place and appoints a properly trained radiofrequency safety officer (RFSO) in writing to manage the program (see AR 385-10).

*h. Commanding General, U.S. Army Training and Doctrine Command.* The CG, TRADOC—

(1) Integrates appropriate radiation safety training in military occupational specialty and specialty skill identifier producing courses.

(2) Makes available radiation safety training modules for deploying and deployed personnel about protection from U.S. and foreign ionizing and non-ionizing radiation sources (including depleted uranium (DU) munitions) that may expose Army personnel to radiation during deployment (see AR 385-10).

(3) Provides short courses to qualify unit, garrison, installation, Army National Guard (ARNG), and U.S. Army Reserve (USAR) RSOs. (For the purposes of this pamphlet, short courses are 3 weeks or less in duration) (see AR 385-10).

(4) Coordinates training material with the appropriate Army commodity licensees and MEDCOM to ensure NRC and ARA compliance with training materials.

*i. Commanding General, U.S. Medical Command.* The CG, MEDCOM—

(1) Makes available radiation safety training modules for deploying and deployed personnel about health hazards of, protection from, and medical treatment of injuries caused by U.S. and foreign ionizing and non-ionizing radiation sources (including DU munitions) that may expose Army personnel during deployment.

(2) Provides, with services available from the USAPHC on a reimbursable basis, RSP assessment services for garrison surveys to assist and ensure NRC license, Army reactor permit, ARA holder regulatory compliance or Federal/Army regulatory compliance. Establishes, when required, appropriate occupational health surveillance programs for personnel occupationally exposed to radiation.

(3) Performs health hazards assessments of commodities and systems that emit radiation or contain RAM as early as practical in development and before fielding (see AR 40-10).

(4) Provides, with services available from USAPHC, radiation bioassay services (see AR 40-5 and DA Pam 385-25) that comply with criteria of the American National Standards Institute (ANSI) N13.30.

(5) Provides medical support for investigations of alleged radiation exposures in excess of established limits (see DODI 6055.05, DODI 6055.08, DODI 6055.11, DODI 6055.15, and DA Pam 385-25).

(6) Coordinates training material with AMC commodity licensees, ARA holders, and TRADOC to ensure field compliance with AMC NRC licenses and ARAs.

*j. Assistant Chief of Staff for Installation Management.* ACSIM—

(1) Provides oversight for all radioactive contamination surveys conducted in support of base closure or installation restoration activities as per AR 385-10.

(2) Ensures closure surveys are conducted in accordance with applicable state, local, and NRC requirements. Implementation guidance is found in the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) and agreements with regulatory agencies.

(3) Coordinates surveys with the responsible NRC license holder and ARA holder.

(4) Ensures contamination surveys solely releasing areas where AMC NRC license radioactive commodities were used follow chapter 9 guidance for surveying radioactive commodity sites.

*k. Commanding General, U.S. Army Intelligence and Security Command.* Ensures that the National Ground Intelligence Center provides expertise as required to properly identify foreign radiological sources and equipment known to contain radioactive sources.

*l. Commander or Director Army command, Army service component command, direct reporting unit.* Each ACOM, ASCC, DRU commander and director—

(1) Ensures command compliance with conditions of NRC licenses and ARAs, including AMC-held radioactive commodity licenses (see para 2-1b). Considers using memorandum of agreement or similar mechanisms to clarify the relationship between the Army Headquarters ACOMs, ASCCs, DRUs, and the NRC license holder.

(2) Designates, in writing, an RSSO who is properly trained and qualified (see chap 7).

(3) Issues ARAs (see para 2-3).

(4) Establishes and employs, as applicable, procedures to ensure that captured, purchased, borrowed, or otherwise

obtained foreign equipment and materiel are surveyed for RAM and that appropriate actions are taken following discovery of any RAM in those items.

(5) Maintains the RSP by—

(a) Establishing review and approval procedures for integrating RM into all operations involving radioactive materials in accordance with AR 385–10, DA Pam 385–30 and ATP 5–19.

(b) Ensuring the RM process is executed before conducting radioactive materials operations.

(c) Ensuring, for programs under their purview, that each NRC license, Army reactor permit, ARA, and RSP is reviewed annually and inspected periodically for compliance with applicable radiation safety and health regulations and guidance. These inspections should be performed at a frequency commensurate with the associated hazard, but should not to exceed 5 years.

*Note.* Applicable radioactive commodity licensees may require more frequent inspections. These services may be provided by the IG or USAPHC.

(d) Ensuring, that in the event of an NRC violation or radiation accident at a facility involving AMC-licensed RAMs that result in NRC escalated enforcement actions against an AMC commodity licensee, any resulting administrative civil penalty is shared between AMC and the responsible command as mutually agreed between their respective radiation safety offices, based on an evaluation of the nature of the alleged violations and penalty assessment.

(6) Ensures a laser safety program is in place for the command if Class 3B and Class 4 lasers are in use, and appoint a properly trained LSO, in writing, to manage the program.

(a) Tracks DOD military-exempt lasers to ensure compliance with the FDA military exemption (FDA exemption no. 76EL–01DOD). Dispose of DOD military exempt lasers that are not classified in the interest of national defense and have usable lasers or laser parts through utilization outside of the DOD, through donation or sale only after ensuring that the laser is brought into compliance with the FDA regulations or the purchaser requests a variance from the FDA, or in the case of foreign military sales, the latest guidance from the FDA is followed.

(b) Disposes of unusable, classified lasers or laser parts to the Defense Logistics Agency Disposition Services for utilization screening within DOD (see DOD 4160.21–M–1).

1. Maintains accountability during the screening period. (Losing and gaining organizations transfer excess directly between themselves.)

2. Identifies requirements for usable parts and returning them to the supply system after utilization screening has been completed.

(7) Ensures an electromagnetic RSP is in place, if necessary, and appoint a properly trained RFSO in writing to manage the program (see AR 385–10).

*m. Commander or director.* Each commander or director—

(1) Designates, in writing, a RSO when any of the following is true:

(a) An NRC license, Army reactor permit, ARA, or applicable technical publication requires an RSO to be appointed.

(b) Requires personnel in the command to wear ADC-issued dosimetry (see para 5–1d).

(c) Requires personnel in the command to participate in a bioassay program (see para 5–1e).

(d) A deployable unit possesses radioactive commodities or radiation emitting equipment that requires the implementation of an RSP (for example, leak testing, radiation postings, and shipping requirements).

(2) Designates, in writing, an LSO when any of the following is true:

(a) The activity operates, maintains, or services a Class 3B or Class 4 Laser System (see ANSI Z136.1).

(b) The activity operates, maintains, or services military-exempt laser systems.

(3) Designates, in writing, an RFSO whenever there are RF or electromagnetic radiation (EMR) sources from that exceed the exposure reference levels (ERLs) limits of IEEE C95.1–2345.

(4) Ensures that when paragraphs 1–4l(1), 1–4l(2), and 1–4l(3) of this pamphlet requires the designation of an RSO, LSO, or RFSO—

(a) The RSO, LSO, or RFSO designee is trained (and periodically retrained, as necessary) to a level commensurate with the RSP scope and responsibilities (see chap 7).

(b) The RSO, LSO, and RFSO ensures that the command's written radiation safety policies and procedures are in compliance with applicable Federal, DOD, and Army radiation safety regulations and directives. These documents include emergency reaction plans, as necessary, and procedures for investigating and reporting radiation accidents, incidents, and over exposures (see chap 6).

(c) The RSO, LSO, and RFSO ensures that they or an internal or external agent or agency audits the RSP annually and copy furnishes the garrison RSO and the command RSSO.

(5) Ensures all personnel occupationally exposed to radiation receive appropriate radiation safety training commensurate with potential workplace hazards.

(6) Maintains an inventory of licensed or authorized ionizing radiation sources, Class 3B, Class 4, and military-exempt lasers, and EMR sources from 0 Hz to 300 GHz that can exceed the ERL of IEEE C95.1–2345, Army reactor

permits, ARAs, and technical publications. Inventories must be updated annually or more often if required by NRC license conditions or local procedure. A copy of the inventory will be furnished to the garrison RSO annually (or more frequently if necessitated by inventory changes) and to the command RSSO.

(7) Establishes written policies and procedures to ensure compliance with radiation safety requirements in applicable technical publications governing the use of radioactive commodities, lasers, and EMR sources from 0 Hz to 300 GHz (see para 2-3b(1)).

(8) Establishes radiation safety committees (RSCs) required by technical publications or conditions of an NRC license, Army reactor permit, or ARA, in accordance with AR 385-10.

(9) Oversees the integration of RM into the ARSP.

(10) Reports radiation accidents and incidents when required by AR 385-10, DA Pam 385-40, 10 CFR, or 49 CFR to the chain of command, the command RSSO, the appropriate NRC license holder, and the garrison RSO.

*n. Commander, garrison.* Each garrison commander—

(1) Designates as necessary, in writing, a garrison RSO who is properly trained and qualified (see chap 7).

(2) Establishes an RSC for the senior commander as proscribed in AR 385-10.

(3) Prepares and maintains historical records of locations of use or storage of RAM on the installation and the responsible activity for that use or storage (see para 2-8c).

(4) Maintains documentation listing locations categorized as “RF controlled environments” where potential electromagnetic field (EMF) exposures to personnel above the action level could occur, as per DODI 6055.11 and chapter 4, below.

(5) Issues Army radiation permits (ARPs) (see para 2-7 and AR 385-10).

(6) Obtains radiation safety resources from outside the command by contracting, memorandum of agreement, or memorandum of understanding, as necessary, to meet the garrison RSP requirements, if the organization lacks organic capability.

(7) Maintains an inventory of radiation sources as higher headquarters directs and in accordance with requirements of NRC licenses, Army reactor permits, ARAs, and technical publications. Inventories are updated annually or more often if required by NRC license conditions or local procedure.

(8) Establishes written policies and procedures to ensure compliance with radiation safety requirements in applicable regulations and technical publications governing the use of radioactive commodities (see para 2-3b(1)).

*o. Army radiation safety officer.* The ARSO—

(1) Oversees the ARSP on behalf of the DASAF.

(2) Develops, manages, and promulgates Army radiation safety policy and guidance on behalf of the DASAF.

(3) Promulgates Federal and Army radiation safety personnel exposure standards within the Army in coordination with the radiological hygiene consultant to TSG.

(4) Provides HQDA oversight of the DOD executive agency for low-level radioactive waste, to include matters concerning DU on behalf of the ASA (IE&E).

(5) Resolves radiation safety issues among U.S. Army Headquarters as necessary.

(6) Promotes good radiation safety practices throughout the Army.

(7) Provides radiation safety consultation to the DA staff, U.S. Army Headquarters commanders and staffs.

(8) Serves as HQDA radiation safety point of contact with other DOD and Federal agencies.

(9) Represents HQDA on DOD RSCs, working groups, and panels.

(10) Provides technical input to HQDA-level radiation safety plans and responses to radiation emergencies, accidents, and incidents.

*p. Radiation safety staff officers.* The ACOMs, DRUs RSSOs—

(1) Ensures implementation of Army radiation safety policy within their respective areas of responsibility.

(2) Oversees their command’s RSP.

(3) Establishes radiation safety policy for their respective areas of responsibility.

(4) Provides radiation safety consultation to their respective command and leadership chains, staffs, and to subordinate commanders and staffs.

(5) Coordinates reporting of radiation accidents and incidents involving RAM or radiation generating device (RGD) with the applicable licensee or permit holder.

(6) Serves as their organization’s radiation safety point of contact.

*q. Army service component command radiation safety staff officer(s).* The ASCC RSSO—

(1) Serves as the principal advisor to the commander, ASCC and staff on RSP issues.

(2) Provides centralized, theater-level oversight and guidance to health physics/radiation safety personnel and/or radiological response teams.

(3) Manages transition-to-war and transition-to-peace radiation safety issues involving radioactive commodities, RGD, radiation survey instrument calibration, radiation safety training, DU training, radiation dosimetry, laser safety, and RF radiation safety.

(4) Monitors the oversight of and guidance on DU issues, to include friendly fire incidents, battle-damaged vehicle recovery, and contamination.

(5) Provides guidance on damaged radioactive commodities and coordination with continental United States (CON-US)-based NRC license holders.

(6) Evaluates reports from health physics and radiation safety personnel and radiological response teams, and guidance to the command staff in the event of a radiological or nuclear event.

(7) Ensures radiological detection equipment, sampling equipment, and personnel dosimetry are used, stored, and maintained in accordance with applicable technical manuals (TM) and guides.

(8) Designs and directs the implementation and execution of the radiation survey program (other than combat surveys for nuclear weapon fallout).

(9) Conducts comparisons of radioactive survey sampling results against preset action levels and communicates survey results and analyses to the command staff.

(10) Provides guidance radiation safety redeployment issues involving radioactive commodities, unwanted radioactive material, and radioactively contaminated vehicles and equipment, including, when applicable, foreign radioactive sources.

(11) Coordinates with medical support on the identification and follow up of Soldiers potentially contaminated with radioactive sources to include DU.

*r. Nuclear Regulatory Commission license radiation safety officer.* Each NRC license RSO—

(1) Within each AMC Life Cycle Management Command (LCMC) is a designated health physicist (HP) who is assigned to manage the command's NRC license.

(2) The NRC License RSO authority extends to different Commands and other Services.

(3) Their duties include:

(a) Provide oversight in implementing NRC license conditions for a particular licensed device.

(b) Prepare NRC license applications and amendments for submission to the NRC.

(c) Determine the proper radiological controls to assure the As Low as Reasonably Achievable (ALARA) policy is being followed.

(d) Perform NRC license inspections to ensure compliance.

(e) Coordinate with various level RSOs from different commands and other Services to ensure license compliance and provide technical assistance.

(f) Coordinate with other AMC LCMCs and program management offices to ensure proper demilitarization.

*s. Garrison radiation safety officer.* Each garrison RSO—

(1) Establishes and directs the garrison RSP (to include a written RSP document).

(2) Assists units, tenants, civilian activities, and contractors on the installation to meet requirements of NRC licenses and ARAs for radioactive commodities. In particular, the garrison RSO—

(a) Assists units and tenants with radiation safety training support.

(b) Reports accidents or incidents involving Installation Management Command (IMCOM) activities or units to the applicable NRC licensee and the IMCOM RSSO (see para 6-1).

(c) Advises on appropriate radiation source inventory control and security of the material.

(3) Notifies the affected mission commander and the AMC RSSO (Army Materiel Command Radiation Safety Staff Officer, 4400 Martin Road, Redstone Arsenal, AL 35898) when a building or area that currently or formerly contained radioactive commodities is scheduled for demolition or no longer contains radioactive commodities. This process provides stakeholders with appropriate notification for decommissioning actions as necessary.

(4) Administers the garrison ARP program (to include maintaining records of ARP applications and ARPs issued by the garrison commander) (see para 2-7 and AR 385-10).

(5) Administers the garrison RSC, if applicable.

(6) Documents, stores, retains, and preserves garrison RSP records properly, including radiation contamination survey reports in accordance with AR 25-400-2, to ensure availability during decontamination and decommissioning of facilities.

(7) Coordinates as necessary with mission RSOs, medical officials, and emergency response personnel (both military and civilian, if appropriate) to establish plans and procedures for responding to credible radiation emergencies on the installation.

(8) Coordinates with the medical authority on occupational monitoring requirements for garrison radiation workers.

(9) Provides training, guidance, and technical support to garrison security forces and fire departments with fixed or portable radiation detection systems, or mobile imaging systems used for force protection purposes.

*t. Radiation safety officer, laser safety officer, or radiofrequency safety officer.* Each RSO, LSO, or RFSO, including the garrison RSO, provides the following functions, for radiation sources within their organization's responsibility:

(1) Performs or be responsible for the performance of all radiation safety functions that are applicable to Federal, DOD, and Army regulations and NRC licenses, Army reactor permits, and ARA condition requirements.

(2) Properly documents, stores, retains, and preserves RSP records, including annual physical inventories and radiation and contamination survey reports, to ensure availability during decontamination and decommissioning.

(3) Establishes plans and procedures for handling credible emergencies involving radiation and RAMs. This includes coordination with civilian and military emergency response organizations as necessary.

(4) Coordinates with supporting medical personnel to ensure that personnel receive appropriate occupational health surveillance (see AR 40–5).

(5) RSOs with laser safety responsibilities, assume the responsibilities of an LSO as listed in ANSI Z136.1, except for occupational health responsibilities. The RSO or LSO assists the occupational health physician as necessary in meeting laser occupational health responsibilities.

(6) RFSOs, assume the duties of an RFSO as listed in Institute of Electrical and Electronics Engineers (IEEE) C95.7. The RFSO assists the occupational health physician, as necessary in meeting RF occupational health responsibilities.

*u. Unit radiation safety officer.* Each unit RSO—

(1) Receives instruction on the types of radioactive commodities, ionizing radiation producing devices, lasers, and EMR sources from 0 Hz to 300 GHz within the unit.

(2) Provides user-level training in the radiation safety aspects of radioactive commodity use, laser safety, and EMR sources from 0 Hz to 300 GHz safety or ensures users receive required training.

(3) Develops and maintains a unit standing operating procedure (SOP) for storage, inventory, tracking, and leak testing of radioactive commodities, materials, or sources and response to broken and damaged radioactive sources. Develops and maintains a unit SOP for safe operation, storage, inventory, tracking, accident reporting, and disposal requirements for Class 3B and Class 4 lasers, and EMR sources from 0 Hz to 300 GHz that could potentially exceed the ERL limits.

(4) Manages the inventory of radioactive commodities, ionizing radiation producing devices, Class 3B and Class 4 lasers, and EMF sources that could exceed ERL limits for the unit and establishes controlled areas as required by chapter 5.

(5) Conducts annual or as required by NRC license conditions, physical inventories of RAM and forwards the inventory to their commander, applicable ARA manager, applicable NRC licensee, and the garrison RSO.

(6) Coordinates with the serialization officer to ensure that applicable transactions are entered into the DOD Radiation Testing and Tracking System database in accordance with AR 710–3 as required. While deployed, tracking per AR 710–3 is not required.

(7) Stores and secures radioactive commodities, secured by two independent permanent physical locks, the location properly posted when not in use, and away from flammables/explosives. While deployed, the unit RSO stores and secures radioactive commodities consistent with mission, enemy, terrain, troops, time, and civil considerations.

(8) Conducts surveys of storage areas, as required by the appropriate NRC license.

(9) Performs (or have performed by direct support units) periodic leak tests, as required.

(10) Establishes and maintains a Personnel Dosimetry program as per DA Pam 385–25 (when required).

(11) Conducts transportation surveys and ensures that radioactive commodity shipments are certified by a qualified hazardous material shipping official when required.

(12) Provides shipping information, to include appropriate exposure rate and contamination levels, to the transportation officer or hazardous material officer prior to shipment.

(13) Investigates accidents or incidents involving lost, stolen, broken, damaged radioactive commodities, materials, and sources or malfunctioned safety devices of radioactive commodities.

(14) Coordinates with medical authorities to follow up on possible personnel exposure to RAM.

(15) Secures and stores damaged radioactive commodities, materials, and sources properly.

(16) Reports accidents and incidents to the garrison RSO, command RSSO and the affected NRC license RSO.

(17) Reports lost or damaged radioactive commodities, materials, and sources in accordance with DA Pam 385–40 and AR 385–10, (filling out DA Form 285–AB (U.S. Army Abbreviated Ground Accident Report) and a report of survey as required).

(18) Initiates request for disposal of damaged device through the garrison, command RSSO, and NRC license RSO.

(19) Maintains RSP records.

(20) Maintains “ACTIVE” (health and safety calibrated) radiation detection, indication, and computation instruments required to perform mandated surveys.

*v. Responsibilities of the users of U.S. Nuclear Regulatory Commission licensed radioactive commodities.*

(1) User maintenance involving the radioactive sealed source is not authorized. Perform only authorized maintenance on equipment containing licensed (specific or general) radioactive material.

(2) Have knowledge of TMs, TBs, and manufacturers operating manuals for all radioactive commodities regardless if they are under a specific license, general license, or exempted by the NRC.

(3) Use safe handling procedures at all times when using radioactive commodities as prescribed in operating manuals and TMs.

(4) Recognize when radioactive commodities are damaged.

(5) Ensure the emergency and reporting procedures in DA Pam 385–40 are followed when there is an incident or emergency. A lost or damaged device is considered an incident that requires immediate notification to the applicable Army NRC license RSO.

(6) Bulk storage of radioactive commodities should be properly posted with a caution radioactive materials sign. Contact the specific Army NRC license RSO for the commodity for proper posting requirements.

(7) Do not store radioactive commodities with non-radioactive devices.

(8) Areas that need to have contamination surveys performed should be in accordance with NRC license conditions. License conditions always take precedence over what is noted in TBs or TMs.

### **1–5. Deviations**

*a.* The following personnel may authorize deviations from ARSP requirements on the advice of their RSSO. (Deviations from personnel radiation exposure standards require the approval of TSG and the DASAF).

(1) The CG of each ACOM, ASCC, and DRU.

(2) The Director, IMCOM.

(3) The Superintendent, U.S. Military Academy.

(4) The Chief, National Guard Bureau (NGB). The Chief, NGB may sub-delegate deviation authority to the State Adjutants General.

(5) The Chief, Army Reserve (The Chief Army Reserve may sub-delegate deviation authority to MSC commanders, but no lower than the first O–8 in the chain of command).

*b.* As a minimum, submit the following information to request a deviation:

(1) Reference to the specific standard and to the specific paragraph under which the waiver or exception is being requested.

(2) Reasons why the standard cannot be met.

(3) Interim measures used that compensate for the inability to comply with the standard.

(4) Action being taken to meet the standard and the estimated date the action can be completed.

(5) Statement of the impact, if the waiver or exception is not approved.

*c.* The approval authority may grant deviations for 1 year or less. The approval authority may extend authorized deviations in increments of 1 year or less provided conditions cited in the original deviation remain the same.

*d.* Any accident or incident occurring under an approved deviation results in immediate termination of the approval until the approving authority completes an investigation and the TSG and DASAF revalidates the deviation.

*e.* Requests for deviations from Federal and DOD regulations and standards require the endorsement of the DASAF, and in the case of radiation exposure standards, TSG. Forward requests for deviations to Federal or DOD radiation safety regulations through command channels to the Office of the Director of Army Safety (DACS–SF), 9351 Hall Road, Building 1456, Fort Belvoir, VA 22060–5527. Copy furnish the Army NRC license RSO or ARA holder.

## **Chapter 2 Ionizing Radiation Safety**

### **2–1. Army Radiation Safety Program**

The Army ionizing radiation safety program includes radioactive materials and RGD, An example is an x-ray generating device. The Army ionizing sources are governed by the U.S. NRC radioactive material licenses or ARAs. The ultimate goal of the ARSP is to keep radiation exposure ALARA to Soldiers, civilians, contractors, the general public, and the environment in accordance with 10 CFR 20.1003.

### **2–2. Radiation safety key components**

As part of the Army Safety Program, a radiation safety function consists of management and control processes addressing all aspects of the following key components as applicable.

*Note.* The mandatory components for a solid RSP include inventories, training, surveys (including leak tests), and audits/inspections.

*a.* General Army radiation safety.

*b.* Control measures.

*c.* NRC licenses.

*d.* Army radiation authorizations.

*e.* Army radiation permits.

*f.* Army radiation safety record keeping — to include decommissioning records.

*g.* Training.

*h.* Personnel monitoring — to include external dosimetry and bioassay.

- i.* Radiation safety lifecycle management.
- j.* Inventory and accountability.
- k.* Use and storage.
- l.* Internal and external program reviews.
- m.* Equipment calibration.
- n.* Survey instruments.
- o.* Radiation surveys.
- p.* Shipping, receiving, transferring, and transport.
- q.* Cargo and personnel security screening systems.
- r.* Emergency response.
- s.* As applicable garrison support of tenants and contractors.
- t.* Military operations support.
- u.* Foreign and captured material.
- v.* Range maintenance and disposal.
- w.* Decontamination survey guidance.
- x.* Handling and disposal of unwanted radioactive material.

### **2–3. General**

*a.* AR 70–1 and DA Pam 385–16 apply to developmental and non-developmental materiel containing radiation sources (including commercial off the shelf equipment). Follow the guidance of DA Pam 70–3 and DA Pam 40–11 and ensure a reevaluation of the equipment is made if substantial modifications are made between the initial evaluation and final acceptance or adoption.

*b.* Compliance with NRC regulations and NRC licenses, Army reactor permits, ARA, and Army ARP conditions is required. Copies of the licenses, authorizations, and permits should be provided to USAPHC and posted on the DA RSO Web site [https://cecomsafety.apg.army.mil/RSO2/darso\\_tree.aspx?tg=rso](https://cecomsafety.apg.army.mil/RSO2/darso_tree.aspx?tg=rso).

(1) Army personnel using RAM (including industrial radiography sources) are to comply with all applicable NRC regulations and conditions of NRC licenses, ARAs, and ARPs held by their command or by another command.

(2) Holders of NRC licenses, ARAs, and ARPs have programs in place to ensure all personnel using RAM, radiation sources, or emergency responders that may encounter radiation, are aware of applicable regulations and conditions as appropriate.

(3) Radiation exposures not governed by the NRC are governed by OSHA. For Army radiation exposures, the dose limits of this pamphlet apply when more restrictive than OSHA regulations.

*c.* The RSO and alternate RSO must be appointed in writing at all levels. Designation of an alternate RSO is an effective means to ensure program continuity and command and control of radiation sources in the absence of the primary RSO. It is desirable that the RSO be fully qualified prior to appointment. However, if operational circumstances interfere with the training, the RSO is to be fully qualified within 90 days.

*d.* A qualified expert is required to design, review, and test shielding of barriers and controls for access to radiation areas, high radiation areas, and very high radiation areas. The qualified expert must perform these procedures per applicable regulations and guidelines before routinely using radiation sources within the area. Each design for high radiation and very high radiation areas must receive an independent review by a qualified expert designated by the ARSO, Command RSSO, or an American Board of Health Physics certified HP designated by the ARSO.

*e.* Adopt no practice and conduct no operation involving planned exposure of personnel to ionizing radiation in excess of the applicable exposure standards of table 5–1 (other than deployment operations governed by operational exposure guidance).

*f.* Environmental requirements are in the following guidance, 32 CFR 651, 40 CFR, and AR 200–1.

*g.* Outside the continental United States (OCONUS) control of radiation sources will be in conjunction with host nation authorizations, Status of Forces Agreements (SOFA), Army regulations, international agreements, NRC licenses, and ARAs, as applicable.

### **2–4. Control measures**

*a.* The installation or activity commander with the guidance of the RSO must design, select, use, and maintain radiation exposure control measures to ensure that anticipated and actual occupational doses are maintained ALARA and do not exceed the limits specified in table 5–1. The following guidance may be helpful in achieving this objective and may be developed for specific categories of workers or work situations:

(1) Development of a formal ALARA program with occupational personnel dose equivalent investigational levels as specified in DA Pam 385–25.

(2) Radioactive contamination trigger levels, found in table 5–3, within ionizing radiation source use areas, signal the need for further investigation, recording, intervention, and mitigation.

*b.* An annual radiation safety audit checklist is in appendix B to assist commanders and RSOs in evaluating key radiation safety controls.

## **2–5. Nuclear Regulatory Commission licenses**

*a.* The NRC licenses special nuclear, source, and byproduct material in the U.S. and its possessions. In 2007, the NRC expanded the definition of byproduct material to include accelerator produced and naturally occurring radioactive material.

*b.* Send applications for new licenses, license renewals, and license amendments through command channels to the command RSSO, as appropriate, for review and concurrence to the NRC.

(1) The CG of each U.S. Army headquarters may allow subordinate commanders to forward applications directly to the NRC without U.S. Army headquarters review. The CG, designated executive of the Army command, or the subordinate commanders, or directors signs the license application. The applicant will provide a copy of the application to the command RSSO, the ARSO, and the USAPHC for tracking and archival purposes. Applicant organizations are responsible for the NRC licensing fees.

(2) When compliance with conditions proposed in the application requires efforts of personnel of another command, obtain a concurrence from an authorized representative of that organization. Commands utilize the AMC commodities in accordance with their intended purposes. The RSO needs to ensure coordination with commands involved.

(3) The applicant or ACOM RSSO provides a copy of all correspondence relating to NRC license and amendment applications to the U.S. Army RSO and to the U.S. Army Public Health Command, Health Physics Program (MCHB-IP-OHP), 5158 Blackhawk Road Aberdeen Proving Ground, MD 21010–5403 for archiving, to include environmental documentation required by 32 CFR 651.

(4) Tenant/mission commanders must provide a copy of each NRC license and ARA (including all amendments) possessed by their command, to the garrison commander.

*c.* Army personnel may communicate ARSP concerns directly to the NRC without restriction. Personnel are encouraged to first report concerns to the chain of command for resolution. Guidance on communicating with the NRC is provided on the NRC Form 3.

*d.* When contract employees perform Army radiation work in U.S. Army facilities, on U.S. Army installations, under the auspices of any Army NRC license, the contract must contain specific requirements tying the contract workforce to Army NRC license conditions and other administrative requirements of the ARSP. Contractors work under their own NRC licenses for Government-owned contractor-operated facilities versus working under Army NRC licenses. Contractors may not work under the auspices of any Army NRC license in non-Army facilities, or at off-post locations unless under the direct supervision of an Army RSO and if the work is authorized by the NRC license.

*e.* The RSO, who is named on an NRC license, must be qualified in accordance with NRC guidelines. The RSO should have at least 1 year of experience of managing an NRC license or supporting an NRC license RSO prior to being named the Army NRC license RSO. The Command RSSO reviews and approves the RSO prior to submission of the license application or amendment to the NRC. The Command RSSO notifies the ARSO of any changes in the NRC license RSO.

## **2–6. Army radiation authorizations**

*a.* The Army uses ARAs to control ionizing radiation sources that the NRC does not license (including RGD that emit ionizing radiation).

*b.* The Army's ARA program is similar to the NRC's licensing program. The Army applies NRC regulations and guidance, modified as necessary, in its control of ARA ionizing radiation sources. Most ARA conditions are similar to standard NRC license conditions.

(1) When an ARA applicant for a radioactive material program possesses an NRC license to which ARA RAM use can be linked, the application need only reference the NRC license. The issued ARA that references an NRC license may incorporate the expiration date and all conditions of the NRC license.

(2) The NRC's regulations regarding license-exempt concentrations (see 10 CFR 30.14) and quantities by isotope (see 10 CFR 30.18) are applied similarly to ARA exemption upon HQDA approval. Applicants for such exemptions send supporting documents through command channels to the Director of Army Safety, DACS-SF, 9351 Hall Road, Building 1456, Fort Belvoir, VA 22060–5860.

*c.* An ARA is required for all sources not regulated by NRC except—

(1) Byproduct, source, or special material that the NRC has declared to be license-exempt (see 10 CFR 30, sections 30.14 through 30.20; 10 CFR 40, sections 40.13, 40.14, and 40.11; and 10 CFR 70, section 70.14) or generally licensed (see 10 CFR 31; 10 CFR 40, sections 40.20 through 40.28; and 10 CFR 70, section 70.19). Devices purchased under general license authority do not require an NRC license to be obtained by the Army, but require the Army to operate under procedures established by the manufacturer. This includes that the material cannot be transferred within the Army, without prior coordination with the manufacturer. If the Army does not follow the general license of the manufacture then the Army is in violation of the NRC general license. It is recommended that generally licensed materials used by the Army be covered under an ARA by the command that owns the material.



- (2) Less than 0.1 microcurie (Ci) (3.7 kilobecquerels (kBq)) of radium.
  - (3) Electron tubes containing less than 10 Ci (370 kBq) of any naturally occurring or accelerated produced radioactive material (NARM) radioisotope.
  - (4) RGDs not capable of producing a high radiation area or very high radiation area (for example, 1 mSv (100 millirem) in one hour at 30 centimeters from any surface of the device). However, commanders establish policies and procedures to ensure that design and use of these excepted sources are in compliance with applicable radiation safety regulations and guidelines and that only appropriately trained and authorized personnel operate them. Training records and inventories of RGDs are kept by the RSO overseeing the Radiation Safety program. Organizations operating cargo/vehicle screening systems are issued an ARA from the Command RSSO. Contractors using Army owned x-ray systems on an Army installation must be issued an ARA from the Command RSSO. Contractors using their x-ray systems on Army land need an ARP, trained personnel, and a radiation safety program must be in place to be in compliance with 32 CFR 655.
  - (5) Diagnostic x-ray systems (including medical, dental, and veterinary).
  - (6) Army nuclear reactors and Army reactor-produced RAM that remains at the reactor site are permitted by the Army Reactor Office (see AR 50-7).
- d.* In special cases where NRC general license requirements attach to centrally purchased radioactive devices, the CG, of the ACOM, issues an ARA to ensure that the general license requirements are met, the provisions of paragraph 2-6c(1) notwithstanding. In the case of centrally purchased RGD, the CG, AMC, can issue an ARA to ensure that the safety requirements are met.
- e.* Commanders forward applications for new ARAs, ARA renewals, and ARA amendments through command channels to the appropriate Army command for approval. The ARA application is to be signed by the CG or appointed signature authority that may include subordinate commanders and directors.
- (1) Use DA Form 3337 (Application for Army Radiation Authorization) (locate the form on the Army Publishing Directorate Web site at <http://www.apd.army.mil>) for new ARAs. Use either DA Form 3337 or a memorandum that refers to the original DA Form 3337 for ARA renewals and amendments.
  - (2) When compliance with conditions proposed in the application requires efforts of personnel of another command, obtain a concurrence from an authorized representative of that command (see para 2-5a(2)).
  - (3) The RSSO ensures that applications meet appropriate regulatory and advisory guidelines before sending approval through command channels to the applicant.
  - (4) Tenant commanders provide a copy of each ARA, including all amendments, to the garrison commander.
- f.* The issuing Army headquarters commander is the termination authority for ARAs issued by the Army headquarters. The ARA can be terminated in one of two ways—
- (1) An ARA that is linked directly to an NRC license terminates concurrently with the NRC license, providing that all of the ARA radioactive material and radiation devices and use areas are appropriately dispositioned in accordance with the terms of NRC license termination plan.
  - (2) An ARA that is not linked to an NRC license follows the same general course as terminating NRC licenses. A termination plan approved by the commander and director is required. The RSSO is advised to consult USAPHC or the ARSO for guidance.
- g.* The RSSO provides a copy of all correspondence relating to ARA applications and terminations to the U.S. Army Public Health Command, Health Physics Program (MCHB-IP-OHP), 5158 Blackhawk Road, Aberdeen Proving Ground, MD 21010-5403 for archiving.
- h.* Implementation of an RSP in support of an issued ARA is reviewed annually. If materiel under an ARA is not handled according to the specified requirements, the Command RSSO is notified for corrective action. If the corrective action is not implemented in a timely manner, the ARSO is contacted for resolution.

## **2-7. Army radiation permits**

- a.* Non-military agencies (including vendors and civilian contractors) require an ARP to use, store, or possess ionizing radiation sources on an Army installation (see 32 CFR 655). Non-Army applicants apply by completing the ARP Form, see figure 2-1 for the ARP application form, including supporting documentation (see para 2-7d) to the garrison commander. The letter should be submitted so that the garrison commander receives the application at least 30 days before the requested start date of the permit (see AR 385-10). (For the purpose of this paragraph, ionizing radiation source means any source that, if held or owned by an Army organization, would require a specific NRC license or ARA.)
- b.* The ARP application specifies the start and stop dates for the ARP and describes the intended use of the ionizing radiation source. For sealed sources, an affirmation that leak test requirements are current is included in the application. The garrison commander approves the application only if the applicant provides evidence to show that one of the following is true:
- (1) For installations that maintain exclusive Federal jurisdiction, and installations in NRC non-agreement states, the ARP applicant must possess one of the following that allows the applicant to use the source as specified in the ARP application:

- (a) A valid NRC license.
  - (b) A Department of Energy (DOE) radiological work permit (for work performed under DOE regulations).
  - (c) A State radioactive material license with an NRC reciprocity agreement. The ARP applicant establishes reciprocity by submitting an NRC Form 241 (Report of Proposed Activities in Non-Agreement States, Areas of Exclusive Federal Jurisdiction or Offshore Waters) to the NRC in accordance with 10 CFR 150.20. The NRC limits work performed under a reciprocity agreement to 180 days in a calendar year. Otherwise, an NRC license is required.
  - (d) The NRC or State radioactive material license must specifically authorize the planned use of the material.
  - (e) If applicable, a copy of the sealed source device registry is required prior to approval.
- (2) For installations that maintain concurrent jurisdiction with the state, and are located in NRC agreement states, the ARP applicant must possess one of the following that allows the applicant to use the source as specified in the ARP application:
- (a) A state radioactive material license (issued by the state in which the installation is located).
  - (b) An out-of-state license with host-state reciprocity. The ARP applicant establishes reciprocity by notifying the host state radioactive materials licensing authority before work commences, and complying with host state reciprocity requirements. Some states limit work under a reciprocity agreement to 180 days in a calendar year.
  - (c) The ARP applicant establishes reciprocity by notifying the host state radioactive materials licensing authority before work commences, and complying with host state reciprocity requirements. Some states limit work under a reciprocity agreement to 180 days in a calendar year.
  - (d) A DOE radiological work permit (for work performed under DOE regulations).
- (3) The garrison commander should consult the installation staff judge advocate or director of public works to ascertain the jurisdictional status of the area on the installation where the ARP applicant will use the radiation source. (On some installations, jurisdiction varies by location on the installation.)
- (4) RGDs, the applicant must have an appropriate state authorization that allows the applicant to use the source as specified in the ARP application and can provide documentation that the applicant has in place a RSP that complies with Army regulations, to include training documentation of their personnel and confirmation that National Voluntary Laboratory Accreditation Program (NVLAP) accredited dosimetry is to be used for the work covered under the ARP. Cabinet x-ray systems that are compliant with 21 CFR 1020.40 do not require an ARP to be brought onto an Army installation, but the garrison RSO must be notified prior to the cabinet x-ray being brought onto the installation.
- (5) For overseas installations, the applicant has an appropriate host-nation authorization as necessary that allows the applicant to use the source as specified in the ARP application and has in place an RSP that complies with Army regulations. Applicants will comply with applicable SOFAs and other international agreements.
- c. All ARPs require applicants to remove all permitted sources from Army property by the end of the permitted time.
- d. The ARP application should consist of the following:
- (1) A letter applying for an ARP with supporting documentation.
  - (2) A copy of the NRC license that permits use or storage of radioactive sources, equipment, and devices at Army bases, garrisons, and installations. A copy of a DOE radiological permit with documentation showing that it is valid for the location and operation. A copy of an Agreement State License and if provided, then documentation to show the license is valid on Federal Property. This is usually NRC Form 241, Report of Proposed Activities in Non-Agreement States, Areas of Exclusive Federal Jurisdiction with the NRC in accordance with 10 CFR 150. If work is covered by NRC Form 241, then the work is limited to 180 days in a calendar year, otherwise an NRC license is required. If exempt from NRC licensing or under general licensing, proof of exemption or general licensing must be provided. For NARM, the contractor must provide appropriate NRC or State authorization that allows the contractor to use the radiation emitting sources, equipment, and devices. The licensing must show operational use conditions and restrictions with expiration date.
  - (3) The documentation must specify the start and stop dates for the ARP and describe why the applicant needs the ARP (Proposed Work Statement).
  - (4) Provide the portion of their contract that identifies the location(s) that the source will be used, the length of time required for the source, and the type of use for the source.
  - (5) A copy of the company RSP.
  - (6) A current list of trained and qualified employees using the radiation emitting sources or radiation generating equipment and their training records.
  - (7) The name of the contractor RSO and emergency contact telephone number.
- (a) Operating instruction(s) and technical order(s) for the equipment that contains the radioactive source, provide an indication of whether the sources, equipment, and devices are to be stored on-site overnight and how it is to be stored and secured.
  - (b) Designated storage location and how it will be secured if the radioactive source remains overnight.
  - (c) Proposed marking of the storage location if it exceeds two mR/hr as measured at the surface of the storage container.

- (d) How the sources, equipment, and devices will be stored and secured during lunch hour and breaks.
- (8) How exposure to contractors and Government personnel will be controlled and that NVLAP accredited dosimetry is used for dose of record.
- (9) Emergency Response Plan in case of an emergency for a lost or damaged source, equipment, and device and over exposure incident and injury.
- (10) Current leak tests on radiation sources, equipment, and devices.
- e. Figure 2-1 is a sample of the garrison commanders response to an ARP request. 32 CFR 655.10 permits ARPs to be granted for up to one year. It is the responsibility of the contractor performing the work under the ARP to be responsible for applying and receiving a NRC license if work exceeds more than 180 days out of a calendar year and to be in compliance with each individual states reciprocity agreements.
- f. If a contractor does not have a valid ARP on Army lands, contact the garrison RSO and the contracting officer. Work should be discontinued until a permit is obtained.

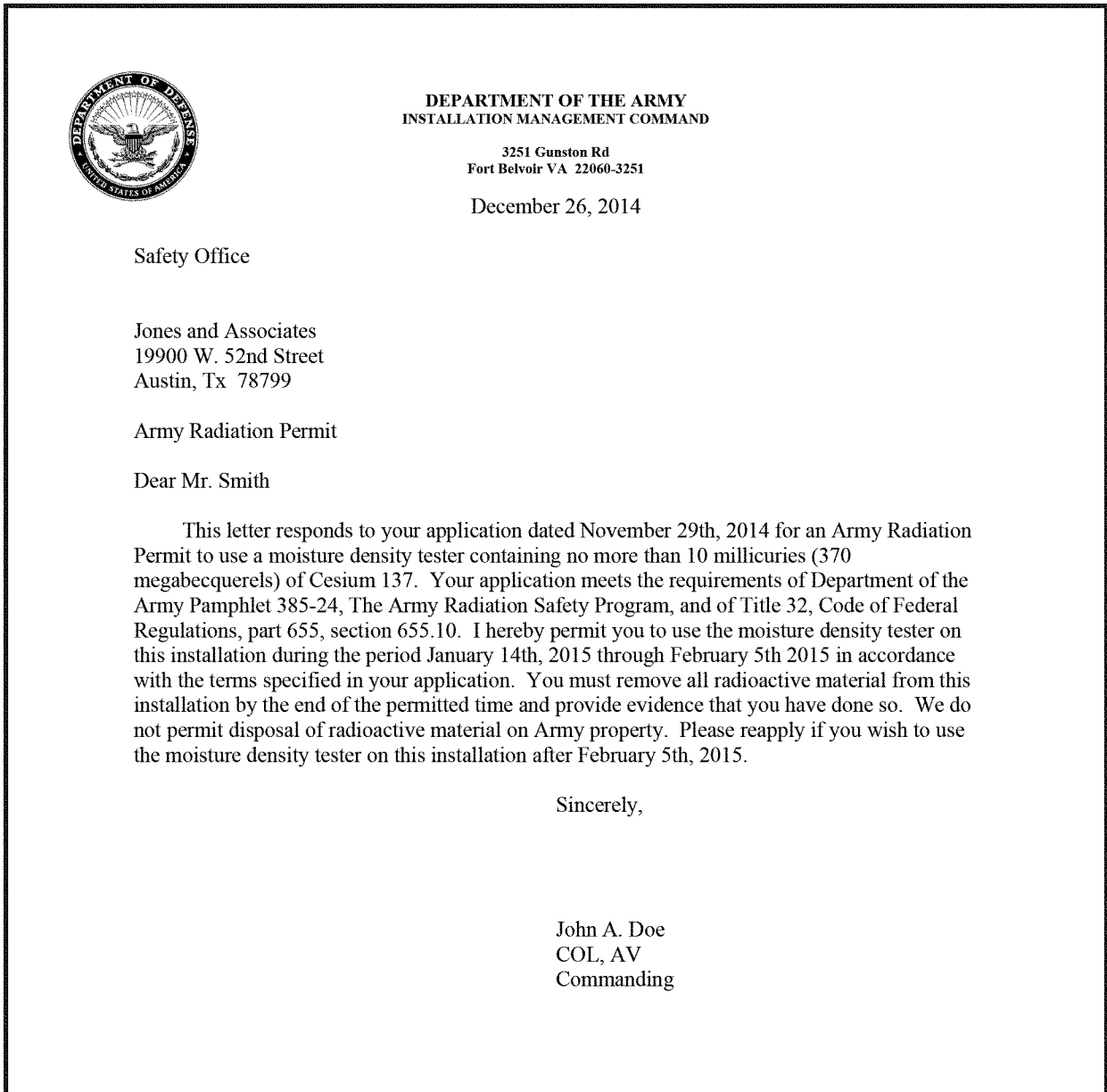


Figure 2-1. Sample Army Radiation Permit

## **2-8. Army radiation safety record keeping**

*a.* NRC licenses conditions for retention of records must be met before considering Army Records Information Management System (ARIMS) guidance.

*b.* ARIMS AR 25-400-2 provides guidance for filing of radiation safety records and proper record disposition requirements.

*c.* The ARIMS Records Retention Schedule-Army contains the guidance on radiation safety files. Visit RSS-A at the following Web site address: <https://train.arims.army.mil/RRSA/SearchResults.aspx>. Log in using your common access card. Use the search tab and type in the keyword section "radiation." Radiation safety files are under 900A Emergency and Safety. There are two categories 0-6 and 6. (plus) years for retention. Click "Search Crosswalk" on the left side of the Web page. Then select the "900 Series: Emergency and Safety." This then provides you the file numbers using the AR 385-10. Click on 900A Safety and then it opens into the 385-10 file numbers with their descriptions. A file structure example is 900A 385-10r1 "Ionizing radiation source accounting records." It is recommended that these files are to be kept 75 years. Contact the ARIMS representative at your organization for information about creating electronic RSP files electronic.

*d.* Decommissioning records follow the guidance provided below.

(1) Holders of NRC licenses will establish and maintain decommissioning records in accordance with 10 CFR 30.35(g), 10 CFR 40.36(f), and 10 CFR 70.25(g).

(2) Holders of ARAs establish and maintain decommissioning records similar to those that the NRC requires.

(3) Tenants holding NRC licenses and ARAs provide information about the location of use and storage of RAM to the garrison commander for the installation RAM history records (see para 1-4l(3)).

## **2-9. Training**

Training requirements are covered in chapter 7.

## **2-10. Personnel monitoring**

Occupational personnel radiation safety monitoring is covered in DA Pam 385-25.

## **2-11. Life cycle management for radioactive commodities and radiation generating devices**

*a.* The overarching goal of the Life cycle Management program is to provide the U.S. Army the radioactive material and radiation producing devices to support the U.S. Army mission. To do this effectively, the RSP has to have accountability of the radioactive material at all times. Proper training and procedures must be in place to use radioactive materials efficiently, effectively, and safely. Training includes proper handling of radioactive materials, inventorying, surveying, and leak testing with calibrated equipment for accurate results and audits of the program. In addition, training must be conducted to ensure proper movement of materials, proper disposal procedures, and processes to ensure radioactively contaminated areas are properly decontaminated and decommissioned for future use.

*b.* Acquisition of material containing radioactive material is covered in AR 70-1 and DA Pam 70-3. Provided below are a few considerations for the acquisition community when considering the use of radioactive materials.

(1) Separate national stock numbers that use radioactive material from non-radioactive versions.

(2) Serial numbers should be used to identify each radioactive source.

(3) Propose not procuring radioactive items if non-radioactive items are available.

(4) Require life cycle costs to be covered (for example, disposal, leak/wipe testing, training, dummy device for training procurement, and inspections).

(5) Plan for disposal, one for one replacement, cost versus benefit analysis, and a tracking system.

*c.* Acquire approval from the Army NRC license holder prior to acquisition.

*d.* The Army controls the distribution and accountability of radioactive material and radiation producing sources through the use of NRC licenses, ARAs, and ARPs. An ARA is used to control specific Army ionizing radiation sources that the NRC does not license. An ARP is used to control non-military agencies bringing ionizing radiation sources onto Army lands. Radioactive material must be controlled through either of these distribution and accountability mechanisms, unless the material is specifically listed as an exempt quantity (see 10 CFR 30.71, schedule B). If a radioactive source exceeds the exempt quantity amount, a license from the NRC must be obtained prior to receiving the material. These licenses normally take 6 to 12 months to obtain. Some systems require a sealed source and device registration that is required prior to even applying for a NRC license.

*e.* Material with smaller quantities may be exempt (see 10 CFR 30.71) or be licensed by the manufacturer as generally licensed material (see 10 CFR 31). Generally licensed items do not require additional NRC licensing, but do require the Army to comply with procedures established by the manufacturer. Transfers of generally licensed items within the Army also require prior coordination with the manufacturer.

*f.* Regardless of the type of acquisition cycle or the point at which a radioactive item enters the acquisition process,

a NRC license or ARA has to be in place to support the acquisition activity except for exempt radioactive materials. If a system enters the acquisition process, the system developer must work with Army Test and Evaluation Command or AMC to ensure the item is supported. This needs to happen as soon as the material is identified as containing radioactive material or produces radiation. This is especially true for commercial off the shelf items.

## **2-12. Inventory and accountability**

Inventories of licensed or authorized ionizing radiation sources (radioactive materials and RGD) will be made in accordance with the NRC license conditions or ARA conditions. The unit RSO or activity RSO is responsible for the inventory. Inventories are provided to the garrison RSO annually and to the command RSSO upon request.

## **2-13. Use and storage**

Use and storage of radioactive materials will be in accordance with the NRC license, ARA, ARP, TB, and TM guidance.

*a. Posting.* The NRC provides guidance on posting storage and work areas based on the amount of material and the dose rates emitted by the device. NRC license applications describe when and what posting is required. Radioactive material signs are prohibited for RGD use. Hazard warning signs for RGD operations are prohibited for use to identify radioactive material storage locations.

*b. Security.* All radioactive sources are to be secured against unauthorized use or removal. Radioactive sources exceeding International Atomic Energy Agency category II require additional security procedures as identified in chapter 8.

## **2-14. Internal and external program reviews**

Reviews are conducted periodically in compliance with NRC licenses or ARAs. As a minimum, an internal review is to be performed annually. An external review is recommended biennially.

## **2-15. Equipment calibration**

*a.* Laboratory instruments require dedicated calibration and check sources. Quality control procedures must be in place to ensure that the equipment is functioning correctly, and the calibration is traceable to the National Institute of Standards and Technology. Calibrating organizations shall adhere to the requirements of ANSI N323 and AR 750-43.

*b.* Calibration sources are of a type and activity appropriate for the intended use of the instrument.

*c.* Calibrate radiation survey instruments used for health or safety purposes at least annually (or as specified in TB 43-0180) using National Institutes of Standards and Technology traceable radiation sources (see TB 750-25).

## **2-16. Survey instruments**

*a.* An adequate number and type of radiation survey meters and monitoring devices will be available to support the RSP. The RSO must maintain at least two survey instruments of each type used to accommodate maintenance and calibration downtime.

*b.* Radiation survey instruments should be response-checked with an appropriate check source before and after use. Fixed, walkthrough, portal, or step-in contamination monitors are response-checked on a routine basis sufficient to ensure satisfactory operation and in accordance with the manufacturer's instructions. A log should be maintained to document these checks.

## **2-17. Radiation surveys**

*a.* Radiation surveys are performed to ensure dose rates and contamination levels are within regulatory limits and meet ALARA goals. Radiation surveys to ensure NRC license compliance are performed in accordance with procedures published by the NRC licensee. The U.S. Nuclear Regulatory Commission Regulation (NUREG) 1556 series of publications also provide information on radiation surveys.

*b.* Radiation surveys performed to ensure facilities and work surfaces are in compliance with AR 385-10 and NRC regulations are semi-permanent records and maintained as directed by AR 25-400-2. A copy is maintained at the facility and by the garrison RSO to assist in future closeouts. These records normally have a disposition of the life of the facility plus 75 years.

*c.* Background measurements must be conducted at locations similar to those being surveyed. The background level is recorded in units of measurement to be used during the survey. The background is subtracted from the survey results to determine actual radiation dose rate or contamination level.

## **2-18. Shipping, receiving, transferring, and transport**

*a.* Transfer radioactive material to authorized persons only.

*b.* Transfer, sale, or donation of Army radioactive commodities and items will be in accordance with NRC general license requirements, DOD, Army technical publications, and applicable instructions established by the holder of the Army NRC commodity license or ARA.

*c.* For all shipping of RAM, the shipper must obtain and retain appropriate evidence that the receiver is authorized

to possess the material (for example, a copy of the recipient's ARA or NRC or Agreement State license) before shipping the RAM.

*d.* Domestic shipments of RAM will be in accordance with applicable NRC (see 10 CFR 71), DOT (see 49 CFR), and DOD 4500.9-R (Part II) requirements. International shipments of RAM will be in accordance with the requirements of the International Air Transport Association Section 10, and the International Maritime Organization and International Maritime Dangerous Goods regulations.

*e.* Report lost or damaged shipments of radioactive commodities to the responsible NRC license, ARA, or ARP holder immediately.

*f.* Class 7, Type A packaging may require additional controls and security. Refer to the applicable NRC license for specified requirements.

## **2-19. Personnel Security Screening System**

*a.* The ARSP for Personnel Security Screening System (PSSS) will conform to ANSI N43.17-2002 The annual effective dose to an individual subject to irradiation by PSSS are limited to 25 mrem (0.25 millisieverts (mSv)) for a single source or venue. Additionally, the following requirements apply:

*b.* General-use systems produce an effective dose per screening of 0.025 mrem (0.25  $\mu$ Sv) or less. Due to the low effective dose per screening, these systems can be used without regard to the number of individuals scanned or the number of scans per year. No special precautions are required for pregnant women or children. Check manufacturers specifications for determining the type of PSSS installed. If further assistance is needed, consult ANSI N43.17 and the command RSSO.

*c.* Limited-use systems produce an effective dose per scan greater than 0.01 mrem (0.1 Sv), and less than 1.0 mrem (10 Sv). Users of PSSS in this category ensure that subjects do not exceed 25 mrem (0.25 mSv) per year as a result of scanning with a given source or at a given venue. Alternative means should be considered for the screening of pregnant women and children. Check manufacturers specifications for determining the type of PSSS installed. If further assistance is needed, consult ANSI N43.17 and the command RSSO.

## **2-20. Cargo and Vehicle Security Screening System**

*a.* Cargo and Vehicle Security Screening Systems are intended for scanning cargo and vehicles and are not designed for personnel scanning. Under normal operating circumstances, these systems are operated in such a manner that avoids intentionally scanning personnel. In circumstances where there is an external threat, such as vulnerability to sniper fire, cargo screening systems may be used as limited-use systems as described in paragraph 2-19c. Screening may be accomplished with a combination of engineering controls and administrative controls.

*b.* Radiation source based cargo and vehicle security screening systems have the potential to exceed the aggregate quantities limits as described in paragraph 8-2 when more than one device is stored in the same location. Such aggregation requires implementing the increased security controls as described in chapter 8.

## **2-21. Emergency response**

*a.* The RSO supports all radiation safety matters for the on-scene-commander, typically the fire chief, who coordinates the emergency response effort.

*b.* The RSO provides radiation safety training to the fire department and emergency response personnel. Emergency response training should be conducted annually or when there is a significant change to the radiation safety emergency response plan.

## **2-22. Foreign and captured material**

The Army does not have a central license holder for foreign radioactive sources. Individual units or installations possessing foreign radioactive sources are required to obtain a license from the NRC in accordance with 10 CFR or an ARA if the radioactive material is not covered by the NRC.

## **2-23. Range maintenance and disposal**

*a.* All range maintenance and disposal actions follow the guidance in DODD 4715.11 Environmental and Explosives Safety Management on Operational Ranges within the United States and DODD 4715.12 Environmental and Explosives Safety Management on Operational Ranges Outside the United States.

*b.* Range maintenance and disposal actions follow the guidance in the NRC licenses or ARA that cover the radioactive material on the range.

*c.* Appropriate fire symbol, chemical, and radiological hazard symbol shall be displayed in such a manner as to be easily visible from all roads of approach. Radiation symbols should conform to the American National Standard on Radiation Symbol, ANSI/HPS N2.1-2013.

*d.* Environmental safety operations where dusts, vapors or gases are present, an industrial hygienist, must evaluate the hazard to determine whether respirators are needed. Identify the appropriate type of respirators in the equipment listed for that operation. No hazardous materials of any kind or hazardous waste will be placed in trash receptacles

destined for the sanitary landfill without prior approval. All waste must be inspected prior to disposition. Ensure compliance with regulatory documents such as Environmental Assessment, Environmental Impact Statements or Environmental Radiological Monitoring Plan. Ensure the monitoring methods are sufficient to detect to levels required by NRC license conditions.

## **2–24. Handling and disposal of unwanted radioactive material**

*a.* Army generators of unwanted radioactive material will implement a plan to reduce unwanted radioactive material volumes to the extent practicable. Where feasible, a single radioactive waste storage point should be established on the installation.

*b.* Do not store radioactive materials with personnel, explosives, flammables, food products, or other incompatible commodities. Items with radioactive gas or radium will be stored in ventilated structures. Storage areas and containers will be marked in accordance with 10 CFR.

*c.* Burial of radioactive waste on Army or DOD-owned or DOD-leased property is prohibited.

*d.* The U.S. Army Joint Munitions Command is responsible for disposal of Army unwanted radioactive material. Waste generators will coordinate with and obtain the approval of the Chief, Army Low-Level Radioactive Waste Disposal Division, U.S. Army Joint Munitions Command, AMSJM–SF, Rock Island Arsenal, Rock Island, IL 61299–6500, for all disposals of DOD unwanted radioactive materials (including approval for the off-site storage, packaging, shipment, treatment, and final disposition of unwanted low-level RAM). Managers of special projects that generate unusually large amounts of radioactive waste (that is, U.S. Army Corps of Engineers environmental restoration projects) may arrange for radioactive waste disposal as part of the project. However, project managers will coordinate DOD radioactive waste disposal actions with the Chief, Army Low-Level Radioactive Waste Disposal Division (see para 1–4*d*(3)).

*e.* The release of RAM into the atmosphere or to the sanitary sewerage system will comply with all applicable NRC and EPA regulations, and applicable state or local requirements.

*f.* If allowed by applicable regulations or by NRC licenses, Army reactor permits, or ARA conditions, RAM may be held for decay and subsequent disposal without regard to radioactivity. However, disposal of such material may still require special handling as hazardous waste.

*g.* Overseas units will comply with the applicable SOFA.

## **Chapter 3 Laser Safety**

### **3–1. General**

*a.* Laser devices will comply with the provisions of the Radiation Safety Performance Standards issued by the FDA, Center for Devices and Radiological Health, 21 CFR 1040.10 and 1040.11 as required by DODI 6055.15, DOD Laser Protection Program. Combat, combat training, and laser devices classified in the interest of national security will comply with 21 CFR to the greatest extent possible (see para 3–2).

*b.* All Army Commands responsible for acquiring laser systems must establish laser safety programs that follow the requirements of DODI 6055.15 and DODI 5000.69 DOD Joint Services Weapons and Laser Systems Safety Processes for all laser systems that are considered joint programs. Joint programs are laser system fielded by two or more DOD components, and one of those components is the U.S. Army.

*c.* A qualified expert is to design, audit, and maintain Army laser safety programs (see para 3–3). Perform these procedures per applicable regulations and guidelines before routinely using laser sources within an approved area.

*d.* Military-exempt lasers (see para 3–2) will comply with laser safety design requirements in MIL–STD 1425A (also found in ANSI Z136.6).

*e.* Army laser range safety guidance is in DA Pam 385–63 and MIL–HDBK 828B.

(1) Lasers intended for ground to ground or air to ground operations and are not above the horizon do not need additional clearance for use.

(2) Lasers aimed above the horizon need further evaluation by a qualified expert to determine if clearance from the Laser Clearing House is required.

*f.* Use of any military-specific laser or any commercial off the shelf laser on an Army range is permitted only if a Joint DOD or USAPHC laser safety hazard evaluation has been performed, documented, and signed for that specific model of laser.

(1) A partial list of lasers that have a laser safety hazard evaluation is in TB MED 524. Send requests for an evaluation of an unlisted laser through command channels to Commander, U.S. Army Public Health Command, MCHB–TS–OLO, Aberdeen Proving Ground, MD 21010–5403, DSN 584–3932 or Commercial (410)–436–3932, laser@amedd.army.mil. Army Commands that acquire lasers shall provide USAPHC with the manufacturer, model, and serial number, if available, of production models of lasers to be fielded.

(2) Use of an unlisted Class 3B and Class 4 laser on an Army range for research, development, testing, and evaluation purposes only when authorized by the LSO and USAPHC. Users of such lasers comply with paragraph 3-1a.

(3) Lasers used for research and development purposes are exempt from the provisions of this paragraph provided the LSO reviews and provides approval.

g. Only a qualified expert (see glossary) is to design, review, and test controls for access to a Class 3B or Class 4 laser facility. Users follow these requirements in accordance with applicable directives before routinely using Class 3B or Class 4 lasers within such a facility. A qualified expert is to write or review for adequacy all laser safety SOPs for each such facility (see para 3-3).

h. Only Class 1, Class 2, and Class 3R lasers may be used indoors on Army installations as hand-held laser pointing devices. Class 3B or Class 4 lasers are prohibited for such purposes.

i. Users are not to conduct an operation involving planned exposure of personnel to laser radiation in excess of the applicable exposure guides (see table 5-2).

j. The LSO maintains an inventory of all Class 3B and 4 and all military exempt laser devices within the organization and update it annually and more frequently if required by local procedure. Laser users should report inventory changes to the LSO as they occur, and reports changes annually (or more frequently if required by local procedure). The LSO forwards the laser inventory to Garrison RSO at least annually.

k. See chapter 6 for accident and incident reporting requirements.

l. See chapter 7 for laser safety training requirements.

### **3-2. Military-exempt lasers**

a. Military specific lasers will meet as many of the laser performance requirements in 21 CFR 1040 as practical. If a military specific laser is unable to comply with all of the provisions of 21 CFR 1040.10, then the manufacturer is responsible for requesting, from the DOD procuring agency, the use of the military exemption. If the DOD procuring agency grants the use of the military exemption, the laser product will be classified in accordance with ANSI Z136.1 and will comply with alternative controls in MIL-STD 1425A. When the exemption is used the contracting officer provides the manufacturer and USAPHC the written military exemption for the specific laser system covered by the exemption. The Program Manager (PM) is the signatory for the military exemption notification. The PM and safety engineers implement the guidance from USAPHC non-ionizing hazard evaluation or provide in writing the rationale why the guidance is not to be implemented. The PM and engineers coordinate with contracting officer, the manufacturer, and the USAPHC on the process to ensure the safety guidance is implemented.

b. Proponents of military-exempt lasers include laser safety requirements in technical publications for siting, operation, and maintenance of these lasers and laser systems. Provided is a list of recommended requirements.

(1) Nominal ocular hazard distances.

(2) Nominal ocular hazard distances for 7 X 50 binocular viewing.

(3) Nominal skin hazard distances.

(4) Optical density requirements for laser eye protection.

(5) Reproductions of all required labels and hazard warnings.

(6) Any appropriate safety instruction to avoid the hazard.

c. Lasers intended primarily for indoor classroom training and demonstration, industrial operations, scientific investigations, or medical applications are not designated military-exempt. CG, USAPHC maintain records indicating the type of product and manufacturer for all Class 3B and Class 4 military-exempt lasers.

d. Army programs granting use of the military exemption to a manufacturer shall provide USAPHC Non-ionizing Radiation Program with a copy of the exemption notification.

e. Once the DOD exemption is applied to a laser system, the working laser system shall not be sold, loaned, or donated outside of the DOD unless the system is brought into full compliance with part 21 CFR 1040. Disposal of exempted lasers will be in accordance with DOD 4160.21-M.

### **3-3. Laser Safety Program**

a. Management at all levels of the Army who employ personnel that operate Class 3B and Class 4 lasers (military specific and nonmilitary) are required to establish and maintain a safety program for the control of laser hazards. Under some circumstances it may be desirable to include Class 1, Class 1M, Class 2, Class 2M, and Class 3R lasers in the safety program if such lasers contain embedded Class 3B or Class 4 lasers that may be accessed during a maintenance procedure.

b. Organizational safety programs and employee training programs, including refresher programs, are required for Class 3B and Class 4 lasers and laser systems.

c. The laser safety program includes the following requirements:

(1) Designation in writing of an individual as the LSO responsible for laser safety to include:



- (a) Maintain adequate policies and procedures that comply with Federal and local regulations for the control of laser hazards.
  - (b) Responsible for assuring that recommended control measures are implemented and maintained. LSO can also approve alternate control measures when the primary controls are not practical. The LSO has the authority to suspend, limit, or terminate the operation of a laser system that is lacking adequate laser hazard controls.
  - (c) A current inventory of all Class 3B and Class 4 lasers (military and non-military), and all military exempt lasers.
  - (d) Initiate the appropriate training and refresher training of authorized laser personnel (for example, LSOs, laser operators, service personnel, and range personnel) in the safe use of lasers and laser systems and control of their hazards.
  - (e) Recommendation or approval of adequate protective measures (personal protective equipment (PPE), barriers, screens) for the control of laser hazards. LSO periodically audits PPE to ensure that it is in proper working order.
  - (f) Documentation of program perspective and procedures including procedures, SOPs, regulations, and points of contact. The LSO approves SOPs and other procedures for Class 3B and Class 4 laser systems that may be part of the requirements for administrative or procedural controls.
  - (g) Review the wording on area warning signs and equipment warning labels.
  - (h) Review Class 3B and Class 4 laser installations, facilities, ranges, and laser equipment prior to use. This includes modifications to existing facilities.
  - (i) Report known or suspected overexposures to laser radiation (see para 6-1a).
  - (j) Implementation of medical surveillance for all required personnel within their program according to current U.S. Army policy.
- (2) Perform periodic update and review of the overall laser safety program including a survey of all areas where lasers are operated and used.

## **Chapter 4**

### **Electromagnetic Radiation Safety**

#### **4-1. General**

- a. As directed in AR 385-10, the Army will comply with the EMF safety program elements in DODI 6055.11. Users of controlled EMF emitting sources, system, devices will comply with radiation safety requirements in applicable technical publications, TB Med 523, and TB 43-0133.
- b. Users will adopt no practice and conduct no operation involving planned exposure of personnel to EMF in excess of the applicable ERL provided below. Based upon IEEE C95.1 and DODI 6055.11 there are two tiers to RF safety exposure limits, controlled environments and action levels for the general public.
- c. The ERLs are a function of frequency and time for electromagnetic fields and radio frequency radiation in the 3 kilohertz (kHz) to 300 gigahertz (GHz) frequency spectrum. These standards are established to protect persons against any adverse health effects and specify exposure levels for personnel protection.
- d. Current scientific evidence indicates that no adverse health effects will occur with exposures that are within the ERLs, even under repeated or long-term exposure conditions:
  - (1) A minimum safety factor of 10 is incorporated into these standards for controlled environments and a minimum safety factor of 50 for the general public.
  - (2) Exposure standards are also assessed with reference to an averaging time that varies with frequency.
- e. The ERLs for the following frequency ranges protect against adverse health effects follows:
  - (1) Between 3 kHz and 5 megahertz (MHz), protects against adverse health effects due to electro stimulation.
  - (2) Between 100 kHz and 3 GHz, limits the specific absorption rate, these basic restrictions are provided in table 4-1.
  - (3) In the transition region between 100 kHz and 5 MHz, EMF safety must protect against both heating effects and electro stimulation.
  - (4) Between 3 GHz and 300 GHz, the ERLs are established to limit adverse health effects due to incident power density.
  - (5) Between 3 GHz and 6 GHz ERLs demonstrate compliance to the standards by incident power density or local Specific Absorption Rate.
- f. In some RF environments, contact with excessively high RF voltages may result in an RF shock or burn. An open voltage of 140 volts root mean squared in the RF field is a conservative criterion used to define the potential RF shock and burn hazard situation.
- g. For high-peak power-pulsed fields, the ERL is 200 kV/m. Additionally, high-peak and electromagnetic pulse are not distinguished.
- h. ERLs for action levels (general public) and the controlled environments are provided in IEEE C95.1-2345. When

developing EMF safety programs, do not apply additional safety margins. The ERL limits incorporate adequate safety margins. An RSP is needed only when EMF levels can exceed the action level. Hence the term action level, only then does there need to be action in place to ensure RF safety. In controlled environments, which translate to awareness, the workers are familiar with electromagnetic energy and have control over their RF environment. In general public environments, people are not familiar with electromagnetic energy and do not have control over the environment.

*i.* Users identify, attenuate, or control potentially hazardous EMF and other radiation hazards associated with Army electronic equipment by engineering design, administrative actions, or protective equipment, (in that order), or a combination thereof. Use process and engineering controls before PPE to protect workers.

(1) Protective clothing is not authorized for protection against EMF-induced shocks and contact burns, or for routine use as a means of protecting personnel from EMF overexposure. PPE, such as electrically insulated gloves and shoes for protection against EMF contact-induced shock or for insulation from the ground plane, is authorized for frequencies less than 100 kHz where necessary for compliance with induced contact current limits (see IEEE C95.1, C95.1–2345, and C95.6).

(2) Protective equipment, such as electrically insulated gloves and shoes for protection against EMF shock and burn, or for insulation from the ground plane, is permissible when engineering controls or procedures cannot eliminate exposure hazards and ensure compliance with induced current limits in DODI 6055.11.

(3) Personal EMF monitors are not approved for routine use as a means of personal protection from EMF exposure.

(4) All PPE is inspected before each use and routinely tested to ensure protective efficacy.

*j.* Proponents of EMF radiation-emitting systems include radiation safety requirements in technical publications about siting, operation, and maintenance of these systems.

*k.* Multiple emitters in fixed arrangements. Where multiple EMF emitters may be collocated in fixed arrangements (such as aboard ships or at communication sites), determine the weighted contribution that should be made to ensure personnel are not exposed to effective EMF levels above the ERLs.

*l.* Multiple emitters in dynamic arrangements. Where multiple EMF emitters may be collocated in dynamic arrangements, computer-aided modeling is needed to determine the weighted contribution that should be made to ensure personnel are not exposed to effective EMF levels above the ERLs. Contact USAPHC on modeling expertise to ensure levels are below ERLs.

*m.* Shielded enclosures and EMF. EMF emitters are used in laboratory settings throughout the DOD to perform verification and validation tests. The shielding effectiveness of the shielded enclosures used to control EMF need to be periodically verified. Engineering controls such as interlocks are necessary to protect personnel from exposure to EMF (see IEEE 299).

*n.* See chapter 6 for EMF accident and incident reporting requirements.

*o.* See chapter 7 for EMF training requirements.

#### **4-2. Measurement and evaluation of electromagnetic field from 0 Hz to 300 GHz**

Use measurement procedures and techniques recommended in IEEE C95.3 as basic guidance for evaluating RF hazards. This requirement does not preclude the use of other EMF measuring and evaluation methodologies.

*a.* Commanding General, USAPHC, maintains records of surveys, reports, calculations, and control measures for each type-classified EMF emitter.

*b.* Commands and installations maintain records of surveys, reports, calculations, and control measures for on all EMF emitters that could exceed the ERL on their inventory. The inventory should include documentation defining locations categorized as “EMF-controlled” and “EMF-action levels” (public and uncontrolled).

*c.* Where multiple RF EMR emitters are located, RF evaluation data will include a determination of weighted contributions from expected simultaneously operated emitters.

*d.* Ensure that EMF emitter evaluation data is provided to the Army Spectrum Management Office to confirm the data collected is in accordance with the data provided in the Spectrum Supportability Risk Assessment and DD Form 1494 (Application for Equipment Frequency Allocation). Ensure data is included in the Army Spectrum Management Program.

#### **4-3. Electromagnetic field controls**

*a. Action level.* Establish and maintain control over areas where potential EMF exposures to personnel above the action level could occur. The lower-tier exposure limit, below the action level, is when exposures are controlled through the implementation of an EMF safety program. To prevent exposures to personnel above the ERL and action level, use the ERLs specified in IEEE C95.1–2345.

*b. Electromagnetic field warning signs.* The EMF warning sign formats specified in the IEEE C95.2 or adequate variation are permitted to identify EMF hazards and properly instruct individuals of the dangers.

(1) Variations to include subdued signs for camouflage or tactical reasons, or to provide improved visibility under certain lighting conditions, are authorized provided the general layout of the signs remains the same. EMF warning signs are required at all access points where levels exceed the controlled environment ERLs listed in IEEE C95.1–2345.

(2) Where the EMF levels exceed the uncontrolled environment ERLs or actions levels, post warning signs according to IEEE C95.7 figure 1 and as per radiation safety, safety engineers, or occupational health professionals. Insert instructional or warning statements on the signs, as appropriate. Where EMF warning signs create unacceptable operational risks, institute documented alternate procedures for informing personnel of EMF hazards.

(3) EMF caution, warning, or danger signs are required at all access points where EMF levels exceed the controlled environment ERLs.

(4) "CAUTION" signs are more commonly applied to alert personnel to the possibility of exposures exceeding the ERL level.

(5) "WARNING" signs are normally used to advise of potential EMF exposures that may exceed ERL level by a factor of 10.

(6) "DANGER" signs are normally only used for situations in which immediate and serious injury will occur such as in the case of RF burns and RF electrical shocks.

*c. Post warning signs.* Post notification signs where the general public may be exposed to EMF levels exceeding the uncontrolled environment ERLs or action levels.

*d. Instructions.* Insert instructions or statements on the signs, as appropriate. Where EMF warning signs create unacceptable operational risks, institute documented alternate procedures for informing personnel of EMF hazards.

*e. Additional warning devices.* In areas where access to EMF levels greater than 10 times the controlled environment ERLs may exist, warning signs alone may not provide adequate protection. Other warning devices, such as flashing lights, audible signals, barriers, or interlocks, are required depending on the potential risk of exposure. Radiation safety professionals should determine the specific warning devices used.

#### **4-4. Duties of the Radio Frequency Safety Officer**

The RFSO identifies, evaluates, and specifies control measures for EMF sources that may produce fields exceeding the ERL limits. Regions that are normally accessible and exhibit intense EMFs will demand a higher priority when allocating resources for implementing the EMF RSP. The RFSO is responsible for safety analyzes, which may address potential exposure to personnel and potential interference with medical devices. Specific duties of the RFSO include, but are not limited to, the following:

*a.* Provide an initial evaluation of the potential for exposure, and monitoring changes (that is, radiation characteristics of the EMF sources or access to controlled areas).

*b.* Maintain an inventory of controlled EMF sources; check TB 43-0133 for guidance if a source needs an EMF safety program.

*c.* Evaluate and implement recommended safety procedures (for example, use of signs, barricades, published safety procedures for identified user activities).

*d.* Document the EMF safety program.

*e.* Monitor relevant regulations relating to EMF safety.

*f.* Disseminate information on EMF safety policy within the organization.

*g.* Provide advice on the interpretation of policies and procedures related to EMF safety.

*h.* Review and authorize EMF surveys and hazard control measures.

*i.* Designate qualified EMF safety personnel.

*j.* Provide EMF safety awareness training and maintaining training records.

*k.* Conduct or arrange regular site audits (at least once every three years) for compliance with EMF safety policies.

*l.* Conduct an annual review of EMF hazard survey policies and procedures to ensure that they adequately reflect best practices and regulatory requirements.

*m.* Investigate breaches of EMF safety policies and procedures or accidental EMF over-exposure incidents.

*n.* Archive all documentation associated with EMF safety in the organization in accordance with DODI 6055.11 and ARIMS.

#### **4-5. Siting of commercial telecommunications equipment on Army installations**

Guidance for siting of commercial telecommunications equipment on Army installations is obtained from the Defense Information Systems Agency Joint Spectrum Center DSN 281-2555 or commercial (410) 293-2555.

## Chapter 5 Radiation Safety Standards, Area Designations, and Contamination Limits

### 5-1. General

*a. Ionizing radiation.* Personnel exposure limits in this chapter do not apply to doses or exposures due to background radiation, medical administration the individual has received, or voluntary participation in medical research programs.

*b. Personnel exposure standards.* Table 5-1 summarizes Army occupational ionizing radiation exposure standards. For ARPs OCONUS, table 5-1 standards apply unless more restrictive standards are required by SOFAs.

*c. Dosimetry.* Army requirements for wearing and recording exposures to ionizing radiation are found in DA Pam 385-25.

*d. Additional requirements.*

(1) *Nuclear Regulatory Commission jurisdiction.* Standards for exposure to ionizing radiation emitted from NRC-licensed RAMs are in 10 CFR 20. The Army also applies these standards to Army reactors and a combination of exposures to NRC-licensed RAM and other ionizing radiation sources through the requirements of this pamphlet.

(2) *Occupational Safety and Health Administration jurisdiction.* Federal standards for occupational exposure to all other ionizing radiation sources are in OSHA regulations (see 29 CFR 1910.1096 and 1926.53). See OSHA Directive, CPL 02-00-086 - CPL 2.86 - memorandum of understanding between the OSHA and the NRC, 22 December 1989, for a delineation of radiation sources regulated by each agency. However, adhere to the standards of this pamphlet for all ionizing radiation sources when these standards are more protective than OSHA standards.

(3) *Federal requirements for security of radioactive material.* Federal requirements for security of RAM; control of access to radiation areas, high radiation areas, and very high radiation areas; caution signs; posting and labeling requirements; RAM shipping and receiving; are cited in 10 CFR, 29 CFR 1910.1096 and 1926.53, 49 CFR, and other applicable documents (see Appendix A). Commanders may waive posting and labeling requirements during deployments and contingency operations on the basis of a risk assessment. Host nation regulations and SOFA requirements must be considered in the waiver analysis.

*e. Non-ionizing radiation.* Table 5-2 provides a description of the EMR spectrum. Refer to the following indicated references for personnel radiation exposure standards for the following types of non-ionizing radiation.

(1) Lasers-ANSI Z136.1 ANSI Z136.3, and ANSI Z136.6, 21 CFR 1040, DODI 6055.15, and TB Med 524.

(2) Ultraviolet, visible, and infrared (IR)-American Conference of Governmental Industrial Hygienists Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices.

(3) Radio frequency electromagnetic fields-IEEE C95.1, 3 kHz to 300 GHz; IEEE C95.6, 0 to 3 kHz, IEEE C95.1-2345 0 to 300 GHz; and DODI 6055.11.

(4) Contact and induced currents-IEEE C95.6, 0-3 kHz.

### 5-2. Area designations

*a.* Areas may be restricted for the purposes of control of access to radioactive materials or to reduce the potential for unnecessary exposure to radiation. Areas with radioactive materials or the potential for radiation exposure are classified as unrestricted, a restricted area, a radiation area, a high radiation area, a very high radiation area, a contamination controlled area, or a radioactive materials area. Definitions for these areas are found in the glossary.

*b.* It is important to use the proper area classification and not over classify an area.

*c.* It may be appropriate to use more than one type of sign, such as a radioactive materials area and a radiation area if both conditions exist.

*d.* Areas with radiation generating devices should be marked for the highest potential exposure and may have a sign that is lighted only when radiation is produced.

### 5-3. Radioactive contamination

ANSI N13.12 is to be used except for compliance with NRC contamination limits. In the absence of other regulatory or advisory guidance, a surface is contaminated if either the removable or total radioactivity is above the levels in table 5-3.

*a.* If a surface cannot be decontaminated promptly to levels below those in table 5-3, control, mark, designate, or post it per applicable regulations. Report the contaminated surface to the appropriate RSO.

*b.* Always reduce radioactive contamination to levels ALARA (see glossary).

*c.* Local commanders and directors may use contamination standards more restrictive than those in table 5-2 but will not use standards less restrictive without applying RM principles (see para 1-10).

*d.* Guidance on radioactive contamination release criteria for decommissioned facilities is available in NUREG 1757.

*e.* As a general practice, Army organizations will not release volumetric-radioactively contaminated materials or items for unrestricted use. Screening levels for volumetric-radioactively contaminated materials are specified by, or

negotiated with, the regulator. For volumetric-radioactively contaminated materials not otherwise subject to regulatory control, screening levels for unrestricted release of items or materials potentially radioactively in volume require approval of the Army RSO.

**Table 5-1**  
**Army personnel ionizing radiation exposure standards<sup>1,2</sup>**

Category	Maximum <sup>2,3</sup>
Member of the general public	100 mrem (1 mSv) (TEDE) in calendar year <sup>3</sup>
Fetus/embryo of occupationally exposed declared pregnant woman	500 mrem (5 mSv) (DDE of mother + DE due to radionuclides in the embryo/fetus and radionuclides in the declared pregnant woman), not to exceed 50 mrem/month (0.5 mSv/month), not to exceed 50 mrem/month.
Occupational exposure of adults	5 rem (0.05 Sv) (TEDE) in calendar year
Lens of the eye	15 rem (0.15 Sv) (EDE) in calendar year <sup>4</sup>
Individual organ	50 rem (0.5 Sv) (DDE + CDE) in calendar year
Skin or extremity	50 rem (0.5 Sv) (SDE) in calendar year
Occupational exposure of minors under age 18	0.5 rem (0.005 Sv) TEDE in a calendar year
Emergency worker-nonlifesaving	5 rem <sup>5</sup>
Emergency worker-lifesaving	25 rem <sup>6</sup>
Emergency worker-lifesaving	50 rem <sup>7</sup>

Notes:

<sup>1</sup> From 10 CFR 20. Refer to 10 CFR 20 for detailed standards. For deployment and combat actions, see also JP 3-11.

<sup>2</sup> Abbreviations: TEDE=total effective dose equivalent; DDE=deep dose equivalent; ED=effective dose; EDE=effective dose equivalent; CDE=committed dose equivalent; SDE=shallow dose equivalent.

<sup>3</sup> The dose in any unrestricted area from external sources, exclusive of the dose contributions from patients administered RAM and released in accordance with applicable regulations, will not exceed 2 mrem (0.02 mSv) in any one hour.

<sup>4</sup> OSHA standard for occupational exposure of adults and the lens of the eye is 1 1/2 rem in a calendar quarter. OSHA standard for skin of the whole body is 7 1/2 rem in a calendar quarter. OSHA standard for hands and forearms; feet and ankles is 18 3/4 rem in a calendar quarter.

<sup>5</sup> Emergency radiation exposure to incident responders should be controllable to this limit in almost all situations. The on-scene commander may increase the limit when all reasonable dose-limiting actions have been employed, and increased dose is unavoidable.

<sup>6</sup> Only on a voluntary basis where a lower dose limit is not practicable.

<sup>7</sup> Only on a voluntary basis where a lower dose limit is not practicable, and only to personnel fully aware of the risks involved, including a substantial increase in their lifetime cancer risk.

**Table 5-2**  
**Electromagnetic radiation**

Region	Wavelength <sup>1,2</sup>	Frequency <sup>1,2</sup>	Authority <sup>3</sup>
Ionizing (gamma and x-rays)	less than 100 nm	more than 3 PHz (Energy greater than 12.4 eV)	NRC, OSHA Army
Ultraviolet (UV)	100 to 400 nm	0.75–0.79 to 3 PHz	ACGIH/FDA
Visible (light)	400 to 780 nm	390 to 790 THz	ACGIH/FDA
Infrared	780 nm to 1 mm	300 GHz to 390 THz	ACGIH/FDA
Radio frequency	1 mm to 100 km	3 kHz to 300 GHz	IEEE/DOD
Extremely low frequency	more than 100 km	less than 3 kHz	IEEE/DOD
Contact and induced current	N/A	NA	IEEE/DOD

Notes:

<sup>1</sup> Wavelength x frequency=speed of light=3 x 10<sup>8</sup> m s<sup>-1</sup>

<sup>2</sup> Unit abbreviations: nm=nanometer (10<sup>-9</sup> m); μm=micrometer (10<sup>-6</sup> m); mm=millimeter (10<sup>-3</sup> m); km=kilometer (10<sup>3</sup> m); PHz=petahertz (10<sup>15</sup> Hz); THz=terahertz (10<sup>12</sup> Hz); GHz=gigahertz (10<sup>9</sup> Hz); kHz=kilohertz (10<sup>3</sup> Hz); and eV=electron volt (1 eV=1.6 x 10<sup>-19</sup> Joule (J)).

<sup>3</sup> The regulating authority for personnel exposure for the purposes of this pamphlet (see para 5-3).

**Table 5-3  
Screening levels for clearance**

Radionuclide Groups <sup>1</sup>	Screening levels (S.I. Units) <sup>2</sup>	Surface Screening (Conventional Units) <sup>2</sup>	Volume Screening (Conventional Units) <sup>2</sup>
	(Bq/cm <sup>2</sup> or Bq/g) <sup>3</sup>	(dpm/100 cm <sup>2</sup> )	(pCi/g)
Group 1 Radium, Thorium, and Transuranics: 210Po, 210Pb, 226Ra, 228Ra, 228Th, 230Th, 232Th, 237Np, 239Pu, 240Pu, 241Am, 244Cm, and associated decay chains <sup>4</sup> , and others <sup>1</sup>	0.1	600	3
Group 2 Uranium and Selected High Dose Beta-Gamma Emitters: 22Na, 54Mn, 58Co, 60Co, 65Zn, 90Sr, 94Nb, 106Ru, 110mAg, 124Sb, 134Cs, 137Cs, 152Eu, 154Eu, 192Ir, 234U, 235U, 238U, Natural Uranium <sup>5</sup> , and others <sup>1</sup>	1	6,000	30
Group 3 General Beta-Gamma Emitters: 24Na, 36Cl, 59Fe, 109Cd, 131I, 129I, 144Ce, 198Au, 241Pu, and others <sup>1</sup>	10	60,000	300
Group 4 <sup>6</sup> Other Beta-Gamma Emitters: 3H, 14C, 32P, 35S, 45Ca, 51Cr, 55Fe, 63Ni, 89Sr, 99Tc, 111In, 125I, 147Pm, and others <sup>1</sup>	100	600,000	3,000

Legend for Table 5-3:

- (1). To determine the specific group for radionuclides not shown, a comparison of the effective dose factors, by exposure pathway, listed in Table A.1 of National Council on Radiation Protection and Measurements (NCRP) Report No. 123 (NCRP 1996) for the radionuclides in question and the radionuclides in the general groups above shall be performed and a determination of the proper group made, based on similarity of the factors.
- (2). Rounded to one significant figure.
- (3). The screening levels shown are used for either surface activity concentration (in units of Bq/cm<sup>2</sup>), or volume activity concentration (in units of Bq/g). These groupings were determined based on similarity of the scenario modeling results, as described in Annex B of ANSI N13.12.
- (4). For decay chains, the screening levels represent the total activity (that is, the activity of the parent plus the activity of all progeny) present.
- (5). Where the Natural Uranium activity equals 48.9% from <sup>238</sup>U, plus 48.9% from <sup>234</sup>U, plus 2.25% from <sup>235</sup>U.
- (6). Radionuclides were assigned to groups that were protective of 10 μSv/y (1.0 mrem/y) and were limited to four groups for ease of application, as discussed in Annex B of ANSI N13.12.

## Chapter 6 Special Reporting Requirements

### 6-1. General

a. Reporting requirements of NRC licenses, 10 CFR, AR 385-10, DA Pam 385-40, and DA Pam 385-25 apply to radiation accidents, incidents, and overexposures. Incidents or accidents involving—

(1) *Radioactive material*. Reported immediately to the NRC license holder (see table 6-1), ARA holder or ARP issuer and the ACOM.

(2) *Manufacturers electronics products*. Examples include x-ray machines for industrial, medical, and research, accelerators, electron microscopes, and neutron generators. Where reasonable grounds exist that an incident has occurred, personnel are encouraged to remain calm, shut off the device, and call the following numbers at USAPHC to report all medical and industrial incidents involving electronic products:

(a) DSN 584-8396 or commercial (410) 436-8396 or after duty hours at (410) 436-4375, DSN 584-4375, DSN Dialing from OCONUS (312) 584-4375, or (800) 222-9698 (24 hour phone lines).

(b) Refer to the USAPHC Web site <http://USAPHC.amedd.army.mil/organization/institute/dohs/Pages/hp.aspx> under Occupational Health Services, Health Physics Program, Resources, for additional information.

(3) *Non-ionizing radiation*.

(a) Suspected laser eye injuries—Immediately evacuate personnel suspected of experiencing potentially damaging eye exposure from laser radiation to the nearest medical facility for an eye examination (OTSG Policy, 11 April 1994). Laser eye injuries require immediate specialized ophthalmologic care to minimize long-term visual acuity loss. Medical personnel should obtain medical guidance for laser injuries from the DOD Laser Injury Hotline, (800) 473-3549, DSN 798-3764, commercial (937) 938-3764, or email [esoh.service.center@wpafb.af.mil](mailto:esoh.service.center@wpafb.af.mil), complete the Laser Injury Electronic Reporting Form at <https://hpws.afrl.af.mil/dhp/OE/ESOHSC/laserinjury/>, and submit the completed report on the incident to the Laser Injury Database <https://hpws.afrl.af.mil/dhp/OE/laserinjury/>.

(b) Suspected overexposure to EMF source—Immediately remove personnel suspected of experiencing the overexposure to the nearest medical facility for care. The medical personnel should obtain medical guidance for the injury from the DOD EMF Injury Hotline, (800) 473-3549, DSN 798-3764, commercial (937) 938-3764, or e-mail esoh.service.center@wpafb.af.mil, complete the EMF Injury Reporting Form at <https://hpws.afrl.af.mil/dhp/OE/ESOHSC/emfinjury/>, and submit the completed report to the EMF Injury Database <https://hpws.afrl.af.mil/dhp/OE/emfInjury/>.

(c) Report all non-ionizing incidents or accidents to—

1. Commander, U.S. Army Public Health Command, 5158 Blackhawk Road, Aberdeen Proving Ground, MD 21010-5403, (800) 222-9698 (24-hour phone line).

2. USAPHC Non-ionizing Radiation Program (DSN 584-3353/3932 or commercial (410) 436-3932/2331 or (800) 222-9698 after duty hours) (e-mail to: [usarmy.apg.medcom-phc.mbx.nonionizing@mail.mil](mailto:usarmy.apg.medcom-phc.mbx.nonionizing@mail.mil)).

3. The Tri-Service Vision Conservation and Readiness Program (TVCRP) should be notified in the event of a laser eye injury. USAPHC TVCRP, (DSN 584-2714 or commercial (410) 436-2714) (email [laserincident@amedd.army.mil](mailto:laserincident@amedd.army.mil)).

b. The NRC license holder reports applicable accidents/incidents to the NRC's 24-hour Headquarters Operations Center (301) 816-5100. The ARA holders and ARP issuers report to higher commands accidents and incidents as required.

c. Notify the garrison or activity public affairs officer at the onset of the accident or incident to activate public affairs contingency measures (see AR 360-1). Radiation accidents or incidents attract the attention of local and national media quickly. Early disclosure of accurate information is vital to maintaining the confidence of both the internal and external public.

d. Accident notification will be completed as per AR 385-10. In addition, the commander experiencing a radiation accident will send an electronically transmitted message to the following addressees, and provide as many details of the accident as possible, in accordance with the Radiological Accident Report format within 24 hours of occurrence to the following addresses:

(1) Commander, U.S. Combat Readiness Center (CSSC-Z), Fort Rucker, AL, at DSN 558-2660/3410, commercial (334) 255-2660/3410 (24-hour phone line), FAX DSN 558-3749, commercial (334) 255-3749 or email [helpdesk@crc.army.mil](mailto:helpdesk@crc.army.mil).

(2) Also notify The Army Safety Office (DACS-SF) at DSN 227-1194/1128, commercial (703) 697-1194/1128 and (SGPS-PSP) at DSN 289-0132/commercial (703) 756-0132 or e-mail [ASO@hqda.army.mil](mailto:ASO@hqda.army.mil) (during non-duty hours, contact the Army Operations Center, DSN 227-0218, commercial (703) 697-0218, and indicate the offices to be notified).

**Table 6-1**  
**Army Materiel Command Nuclear Regulatory Commission commodity license radiation safety officers**

Major Subordinate Command	Phone number	Commodity type
U.S. Army Aviation and Missile Life Cycle Management Command (AMCOM LCMC)	256-842-3250 DSN 687-3250	Am-241 Range Finders and Magnesium Thorium Alloy
Communications-Electronics Life Cycle Management Command (CECOM LCMC)	443-395-3790 DSN 648-3790	Gauges, Optical Coatings, Military Vehicle and Cargo Inspection Systems (MVACIS)
Joint Munitions Command (JMC)	309-782-0338 DSN 793-0338	DU Munitions and Light Anti-tank Weapon Rocket Sights
U.S. Army Tank-automotive and Armaments Command Life Cycle Management Command (TACOM LCMC)	586-282-0891/7635 DSN 786-0891/7635	Tritium/Chemical Agent Detector/Chemical Agent Monitor (H3/CAD/CAM), DU in Tank Armor, Radium Gauges for Vehicles, Vehicle Igniters, Tank Thorium Combustor Liner and Density Moisture Testers
U.S. Army Installation Command (IMCOM)	210-466-0368 DSN 450-0368	M101 DU residue

## 6-2. Other required reporting agencies and time requirements

a. Send information copies of all reports required by 10 CFR 20.2201 through 20.2205, 29 CFR 1910.1096(m), or 29 CFR 1926.53(o) and of any other accident or incident report to the NRC or OSHA through command channels to the Director of Army Safety (DACS-SF), Building 1456, 9351 Hall Road, Fort Belvoir, VA 22060-5527 (DSN 227-1194/1128 or commercial (703) 697-1194/1128) or electronically.

b. Reports through command channels will meet the same time requirements, as do required reports to the NRC and OSHA. For example, if the NRC requires immediate telephonic notification, follow it with immediate telephonic

notification through the chain of command to Director of Army Safety (DACs-SF), Building 1456, 9351 Hall Road, Fort Belvoir, VA 22060-5527 (DSN 227-1194/1128 or commercial (703) 697-1194/1128) or electronically.

### **6-3. Radiological Accident/Incident Report**

- a. The Radiological Accident Report includes the following:
  - (1) Date and time of the event.
  - (2) Radiation-producing device or source involved, including national stock number, serial number, part number, radiation characteristics, and parameters of the event.
  - (3) Description of the event, including cause; names and social security numbers of the people exposed, injured, or contaminated; estimated exposure; contamination levels; facilities effected; potential damages; impact on operations; and immediate-response actions taken.
  - (4) Actions taken to prevent recurrence.
  - (5) Recommendations to avoid similar instances at other installations possessing similar material or devices.
  - (6) Name and telephone number of HP or RSO, field unit identification, and the appropriate ACOM, ASCC, or DRU involved.
  - (7) Point of contact (name, address, and telephone number).
  - (8) A statement of when the appropriate offices in Department of Labor, NRC, and DOT were notified (if applicable) and by whom notification was made.
  - (9) NRC License, Army authorization number, or Army permit number.
- b. Commanders send an electronically transmitted message within 24 hours of the occurrence to higher headquarters and Radiological Consultant to the Surgeon General, and the ARSO.

## **Chapter 7**

### **Training Requirements for Radiation Safety Officers, Laser Safety Officers, and Radiofrequency Safety Officers**

#### **7-1. General**

- a. The RSOs, LSOs, and RFSOs shall be trained to a level commensurate with the duties and responsibilities of the radiation program for which they are responsible, and in accordance with applicable NRC regulations and license conditions, ANSI standards, IEEE standards, DODIs, ARAs, and other program documents (including state regulations as they may apply to National Guard RSOs).
- b. This training is to be completed before the RSO, LSO, and RFSO assumes the RSP responsibility.
- c. Refresher training should occur annually and retraining should occur after a significant regulatory change or every 5 years.
  - (1) Annual refresher training can be accomplished through local training, a distance learning course, or a formal course of instruction.
  - (2) Annual refresher should cover one to the topics described in paragraph 7-2 or a topic specifically designed for the facility, radioactive material, or RGD in use.
- d. Completion of training records guidance is provided in AR 25-400-2.

#### **7-2. Radiation safety officer training requirements**

- a. *Radiation safety officer designation.* An RSO designated in accordance with this pamphlet will have completed a formal course of instruction addressing the following topics:
  - (1) Basic radiation interactions.
  - (2) Radioactivity.
  - (3) Terms and units.
  - (4) Biological effects.
  - (5) Radiation detection and measurement.
  - (6) Radiation and contamination control.
  - (7) Radiation dosimetry.
  - (8) Additionally, the RSO shall receive specific training for Army radioactive commodities or RGD for which he/she is responsible.
  - (9) If NRC license material is involved, ensure item 8 of the applicable NRC Form 313 requirements are met and item 10, of the RSP.
- b. *Acceptable courses for unit and garrison radiation safety officers.* Acceptable courses for unit and garrison RSOs are offered by the U.S. Army Chemical School, MEDCOM, NGB, and AMC licensees. Paragraph 7-2e provides



additional information on courses to satisfy requirements for each level. Commercial courses with similar course material may be acceptable if they meet the NRC license requirements and are approved by the Army RSO.

*c. Certifying radioactive shipments.* Any individual who certifies radioactive shipments must complete training required by 49 CFR 173.1(b) and Defense Transportation Regulation 4500.9-R-Part II.

*d. Unit radiation safety officers.* Unit RSOs for units that possess only chemical detection equipment, fire control devices, DU armored tanks, DU ammunition, DU tank combustor liners or generally licensed equipment may be trained through TRADOC, NGB, locally, AMC licensees, or through the use of computer based training modules. This training must be documented and provide an understanding of the hazards of the material, appropriate control measures, and necessary accident/incident response actions and notifications.

*e. Training requirements.* Training requirements for Army radiation safety professionals.

(1) *Level 4: Health Physicist GS-1306 and MEDCOM Nuclear Medical Science Officers (AOC 72A).* Level 4 Army HPs manage NRC licenses and major Army RSPs involving radioactive sources, energized sources, to include lasers and EMF sources.

*Note.* RSOs on medical licenses may require additional training to meet the 200-hour training requirement for NRC medical licensees prior to assignment as the medical license RSO. Individual who meet the basic standard for a HP, but occupy a different career field, may also meet level 4 qualifications if they have a minimum of 80 hours radiation safety training in the topics listed in paragraph 7-2a.

(2) *Level 3: Radiation safety officers, Garrison or equivalent level radiation safety officers.* The Army Military and Civilian HPs need developmental courses to maintain proficiency Level 3: RSO Garrison or equivalent level RSOs. The garrison RSO needs to have completed the one-week basic RSO course (phase 1) with specific commodity radiation safety training, or alternate AMC NRC licensee training authorized by an NRC license, and receive annual refresher radiation safety training and a one-week advanced radiation safety course (phase 2).

(3) *Level 2: Local radiation safety officers.* RSOs at units or MEDCOM that have a need for a basic radiation safety understanding and specialized radiation safety training to include medical radiation safety, Density Moisture Testers, UDM-2 calibrators, or RGD that have specific radiation safety requirements. An example is the x-ray unit used for nondestructive testing. The local RSO must complete the one-week basic RSO course (phase 1), receive source specific training for items under their purview, and receive annual radiation safety training.

(4) *Level 1: Unit radiation safety officers.* RSOs at units that are responsible for AMC commodities or NRC generally licensed items have to complete a distance learning or resident radiation safety course taught by an RSO level 2 or higher.

*f. Radiation safety for safety professionals.* The radiation safety for safety professionals is not designed to meet any of the RSO requirements, but acts as a familiarization program to understand basic radiation safety and whom to contact for additional expertise. The training is part of the safety professional certification process and is an accredited course by the career program 12 safety certification process.

*g. Army Command radiation safety staff officers.* ACOM RSSOs have training equal to or greater than level 3 RSOs and receive annual refresher training. ACOM RSSOs with multiple NRC licenses within their command should have training equivalent to level 4 RSOs.

*h. Radiation safety instructor qualifications.* TRADOC instructors that have completed their instructor qualification and applicable level of instruction in radiation safety are qualified to instruct those levels which they have completed. Non-TRADOC instructors (that are not GS-1306s or 72As) require completion of, as a minimum, RSO Level 2 training and must have completed an instructor qualification course.

### **7-3. Laser safety training requirements**

*a.* An LSO with responsibility for a laser RSP:

(1) Complete a formal course with a minimum of 10 hours of laser instruction addressing such topics as laser radiation, terminology, biological effects, and exposure control measures.

(2) Refresher training should occur annually and retraining should occur after a significant regulatory change or every 5 years.

*b.* Laser safety training programs are conducted by individuals with knowledge of lasers (general and operational) and laser safety concepts. Depending on the trainees and the level of training being taught, the trainer may also require knowledge on the following topics:

- (1) Laser classification.
- (2) Laser bioeffects.
- (3) Specular and diffuse reflections.
- (4) Control measures.
- (5) Nominal hazard zones.
- (6) Laser eye protection and optical density.
- (7) Non-beam hazards.
- (8) Medical surveillance program requirements.

(9) Accident and incident reporting procedures.

*c.* Training is provided to each LSO, manager of a laser system or laser operational area, and Soldiers and employees working with, operating, or potentially exposed to Class 3B or Class 4 laser radiation and Military exempt laser systems.

*d.* Training should be provided to Soldiers and employees working with, operating, or potentially exposed to Class 1M, Class 2, Class 2M or Class 3R laser radiation.

*e.* The level of training shall be commensurate to at least the highest class of laser within the scope of their job.

*f.* Refresher training shall be provided to each LSO, Soldier, and employees working with, operating, or potentially exposed to Class 3B or Class 4 laser radiation and military exempt laser systems.

(1) Refresher training may be an abbreviated version of the original training, or it may be as simple as a review of an SOP or operator's manual. After this training, personnel should have the necessary laser safety knowledge to continue to work safely with their laser(s).

(2) Personnel that occasionally work with lasers may require more frequent refresher training than persons that work with lasers daily.

*g.* LSO training shall be more comprehensive than that of other personnel working with, operating, or potentially exposed to laser radiation. The training shall be commensurate to at least the highest class of laser within their program. In addition to the topics listed in paragraph 7-3*a* the LSO will receive additional training on the following:

(1) Basic radiometric terms and units.

(2) Types of lasers including laser output parameters.

(3) ERLs.

(4) General understanding of laser hazard evaluation process.

(5) Laser Hazard software.

(6) Laser Range Management Tool software.

*h.* Operators of Class 3B, Class 4 lasers and Military exempt lasers will receive specialized training for the system that they operate to include:

(1) SOPs.

(2) Specific laser system control measures.

(3) Review of all hazard distances for the laser system.

(4) Environments, conditions, and situations where lasers may or may not be operated.

(5) Accident and incident reporting procedures.

(6) Training should include meeting National Environmental Policy Act environmental documentation requirements for potential impact of laser systems on the surrounding environment through interaction with tissue, medical electronics, aircraft, explosives, and fueling operations.

*i.* Acceptable LSO courses are offered by the USAPHC and commercial vendors, such as the Laser Institute of America.

*j.* Laser safety instructor qualifications.

(1) TRADOC instructors that have completed their instructor qualification and the applicable level of instruction in laser safety are qualified to instruct those levels they have completed.

(2) Non-TRADOC instructors (that are not GS-1306s or GS-72As) require completion of, as a minimum, LSO training, and an instructor qualification course.

#### **7-4. Radiofrequency safety training requirements**

*a.* An RFSO with responsibility for an EMF RSP (other than a laser program):

(1) Complete a formal course with a minimum of 10 hours of radiofrequency instruction addressing such topics as EMF radiation, terminology, biological effects, and exposure control measures.

(2) Refresher training should occur annually and retraining should occur after a significant regulatory change or every 5 years.

(3) RFSO training should include the potential impact of RF on tissue, medical electronics, aircraft avionics and controls and communications, air traffic control, explosives, fueling operations, EMS communications, and RF shock hazards.

*b.* MOS 72D (Environmental Science Officer), MOS 74D (Chemical, biological, radiological, nuclear and explosive specialist), the 25 (Signal/Communications) series should be considered to be the unit RFSO and receive training on RF radiation to support the EMF RSP.

*c.* DA personnel who routinely work directly with equipment, to include being responsible for operating, maintaining, and repairing the EMF radiation source, that results in electromagnetic environmental levels in excess of the ERLs receive at a minimum 4 hours of general EMF safety awareness training and 5 hours of EMF safety training on the specific RF system to be used.

*d.* General awareness EMF safety training.

- (1) Is conducted prior to assignment to EMF work areas.
- (2) Personnel are to be aware of potential hazards of EMF, establish procedures, and restrictions to control EMF exposures, and understand their responsibility to limit their exposures.
- (3) Awareness should include the potential impact of RF on tissue, medical electronics, aircraft avionics and controls and communications, air traffic control, explosives, fueling operations, EMS communications, and RF shock hazards.
  - e. Topics of specific EMF training cover the following information.
    - (1) Exposure potential associated with specific equipment.
    - (2) Biological effects associated with overexposure to power density levels exceeding the ERL.
    - (3) Proper use of protective equipment and devices such as barriers, signs, and lights.
    - (4) Routine EMF safety surveys.
    - (5) Awareness should include the potential impact of RF on tissue, medical electronics, aircraft avionics and controls and communications, air traffic control, explosives, fueling operations, EMS communications, and RF shock hazards.
    - (6) Procedures for maintaining an operational log for recording EMF radiation safety related events (such as radiation control area violations or overrides of warning signs or safety interlocks)
    - (7) Training should include meeting National Environmental Policy Act environmental documentation requirements for potential impact of RF systems on the surrounding environment through interaction with tissue, medical electronics, aircraft, explosives, and fueling operations.
    - (8) EMF overexposure reporting procedures.
  - f. Develop a risk communication plan for personnel who may be exposed to EMF from DA sources or known sources in the vicinity of deployed forces.
    - (1) Apply current risk communication techniques for describing risk and the process of risk assessment and characterization (see DA Pam 385-30). Potential EMF exposures in military deployments follow operational risk communication requirements of DODI 6490.03 and DODI 6055.11.
    - (2) At a minimum, address opportunities to ensure potential occupationally exposed individuals, including those with implanted medical devices, metal implants, stents, shunts, or wires, understand the known health implications of system operation.
  - g. Acceptable RFSO training courses are offered by the USAPHC.
  - h. EMF safety instructor qualifications.
    - (1) TRADOC instructors who have completed their instructor qualification and the applicable level of instruction in EMF safety are qualified to instruct those levels they have completed.
    - (2) Non-TRADOC instructors (that are not GS-1306s or GS-72As) require completion of, as a minimum, RFSO training and have completed an instructor qualification course.

## **Chapter 8**

### **Enhanced Security Requirements for Radionuclides of Concern**

#### **8-1. General**

This chapter provides guidance for establishing policy, procedures, and minimum physical security standards for the safeguarding, security, and storage of radionuclides of concern and applies to all NRC license holders and RSOs who possess a quantity of radioactive material at or above the category 2 threshold limit per 10 CFR 37, additional guidance is provided in NUREG 2155.

#### **8-2. Radioactive Source Categories**

a. This chapter provides guidance for establishing policy, procedures, and minimum physical security standards for the safeguarding, security, and storage of radionuclides of concern and applies to all NRC license holders and RSOs who possess a quantity of radioactive material at or above the Category 2 threshold limit per 10 CFR 37, additional guidance is provided in NUREG 2155.

b. Activation products contained in the structure (such as, the stainless steel lining of a reactor vessel, stainless steel bolts, or the reactor hull) would not be subject to 10 CFR Part 37 as long as these materials remain an integral component of a reactor. However, upon decommissioning of the reactor, waste generated from decommissioning may be subject to 10 CFR Part 37 if the waste meets or exceeds a Category 2 threshold. For example, shipments of decommissioned reactor components would be subject to Subpart D if their total activity met or exceeded a Category 2 threshold and if they weighed less than 2,000 kg (4,409 lbs) (see 10 CFR 37.11(c)).

**Table 8–1  
Radionuclides of concern**

	Category 1		Category 2	
	Terabecquerels (TBq)	Curies (Ci)	Terabecquerels (TBq)	Curies (Ci)
Americium-241	60	1,600	0.6	16
Americium-241/Be	60	1,600	0.6	16
Californium-252	20	540	0.2	5.4
Curium-244	50	1,400	0.5	14
Cobalt-60	30	810	0.3	8.1
Cesium-137	100	2,700	1.0	27
Gadolinium-153	1,000	27,000	10.0	270
Iridium-192	80	2,200	0.8	22
Plutonium-238	60	1,600	0.6	16
Plutonium-239/Be	60	1,600	0.6	16
Promethium-147	40,000	1,100,000	400	11,000
Radium-226	40	1,100	0.4	11
Selenium-75	200	5,400	2.0	54
Strontium-90/(Y-90)	1,000	27,000	10.0	270
Thulium-170	20,000	540,000	200	5,400
Ytterbium-169	300	8,100	3.0	81

c. The aggregate activity of multiple, collocated sources of the same radionuclide should be included to determine if the total activity exceeds the Category 2 limit.

d. Radioactive materials are to be considered aggregated or collocated if breaching a common physical security barrier (for example, a locked door at the entrance to a storage room) would allow access to the RAM or devices containing the RAM.

e. If multiple sources of the same radionuclide and multiple radionuclides are aggregated at a location, the sum of the ratios of the total activity of each of the radionuclides must be determined to verify whether the activity at the location is less than the category 2 threshold of table 8–1, as appropriate. If the calculated sum of the ratios, using the equation in figure 8–1, is greater than or equal to 1.0, then the applicable requirements of this part apply. First determine the total activity for each radionuclide from table 8–1. This is done by adding the activity of each source, material in any device, and any loose or bulk material that contains the radionuclide. Then use the equation below to calculate the sum of the ratios by inserting the total activity of the applicable radionuclides from table 8–1 in the numerator of the equation and the corresponding threshold activity from table 8–1 in the denominator of the equation. Calculations must be performed in metric values (that is, TBq) and the numerator and denominator values must be in the same units.

$$\sum_{i=1}^n \frac{R_i}{AR_i} = \frac{R_1}{AR_1} + \frac{R_2}{AR_2} + \dots + \frac{R_n}{AR_n} \geq 1.0$$

- (1)  $R_i$  = total activity for radionuclide  $i$
- (2)  $R_1$  = total activity for radionuclide 1
- (3)  $R_2$  = total activity for radionuclide 2
- (4)  $R_n$  = total activity for radionuclide  $n$
- (5)  $AR_i$  = activity threshold for radionuclide  $i$
- (6)  $AR_1$  = activity threshold for radionuclide 1
- (7)  $AR_2$  = activity threshold for radionuclide 2
- (8)  $AR_n$  = activity threshold for radionuclide  $n$

Figure 8–1. Unity rule for Category 2 sources

f. Radionuclides of concern require protective measures if—

- (1) Any single source is larger than the Category 2 level listed in table 8–1.
- (2) Multiple aggregated sources of the same radionuclide when the combined quantity exceeds the Category 2 level listed in table 8–1.
- (3) For combinations of radionuclides, including multiple aggregated sources of different radionuclides when the aggregate quantities satisfy the unity rule of figure 8–1.

### 8–3. Unescorted access authorization

a. The Army NRC licensee will establish, implement, and maintain an unescorted access authorization program per 10 CFR 37 subpart B and this chapter for individuals who have unescorted access to radionuclides of concern.

b. The Army NRC licensee designates the Army NRC license RSO, Army NRC license alternate RSO, certifying official for the Personal Reliability Program, or local chairman of the RSC as the reviewing official for the unescorted access authorization program. The designation is by command appointment orders. The licensee confirms the reviewing official's trustworthiness and reliability based on a valid security investigation adjudicated to national security standards with eligibility for a security clearance. The reviewing official makes the determination on which individuals are permitted unescorted access to radionuclides of concern.

c. The reviewing official—

(1) Ensures the subject individual has informed and provided a signed consent to the security review as per 10 CFR 37.23(c) before the reviewing official begins any background investigation. The denial or withdrawal of consent by an individual is sufficient cause for the reviewing official to deny or terminate unescorted access authorization.

(2) Ensures the protection of personnel information per 10 CFR 37.31 and AR 340–21.

(3) Reviews the subject individual's investigation file and dossier and the subject individual's personnel file. If the individual is in the Personal Reliability program the review can be coordinated with the certifying official. The review addresses the individual's:

- (a) Criminal history records check.
- (b) Employment history.
- (c) Education.
- (d) Personnel references.

(4) Evaluates the information and make a determination on the trustworthiness and reliability of the individual to be allowed or denied unescorted access to radionuclides of concern. Use NRC guidance such as the relevance factors in Appendix A, NUREG 2155 in evaluating the information.

(5) Notifies the individual in writing of the individual's right to complete, correct or explain any adverse information. The licensee must maintain the confirmation of receipt by the individual of this notification for one year from the date of the notification (see 10 CFR 37.23g for the procedures if the individual believes the criminal history record is inaccurate or incomplete).

(6) Documents all significant actions when allowing or denying unescorted access. If the individual is denied unescorted access, inform the individual of the grounds for the denial and allow the individual an opportunity to provide additional relevant information.

(7) Ensures individuals authorized unescorted access to radionuclides of concern have a reinvestigation as per 10 CFR 37-25(c) within 10 years of the date when unescorted access was granted. Follow the procedures in paragraphs 8-3c(1) to 8-3c(4) of this pamphlet to determine whether the individual's unescorted access authorization is maintained or terminated.

(8) Maintains a roster of individuals with unescorted access authorization.

(a) This roster is signed by the reviewing official and countersigned by the licensee's command security manager. The roster should include the date and type of background investigation completed, and the date when the unescorted access authorization was approved or was last maintained based on a reinvestigation.

(b) The roster is updated when an individual has been newly authorized unescorted access, or when an individual's access authorization is maintained based on a reinvestigation. The roster is updated promptly (but no later than 7 working days) by removing individuals whose unescorted access authorization has been terminated or who no longer require unescorted access.

(9) Obtains documentation of unescorted access authorization for contractor source maintenance personnel.

(a) When source maintenance personnel who require unescorted access are contracted, the maintenance company shall provide to the reviewing official written documentation which includes the name of the employee providing the service and a statement that the employee has been deemed trustworthy and reliable in accordance with 10 CFR 37.29(a)(13).

(b) Unescorted access is only authorized with written documentation and phone confirmation by the reviewing official with the company providing the service and with the contracting officer technical representative of the contract.

d. The Army NRC licensee:

(1) Conduct an annual review of the unescorted access authorization program for content and implementation per 10 CFR 37.33.

(2) Maintain documentation of the unescorted access authorization program per 10 CFR 37.23(h) and 10 CFR 37.33.

#### **8-4. Security of radionuclides of concerns**

a. The security intent and objective is to reduce the risk of malevolent use of radionuclides of concern. Security measures cannot prevent 100 percent of all attempts at theft, sabotage, or diversion; however, in total, the measures provide multiple layers of security, or a "security in depth," that are designed to provide enhanced security and mitigate potential consequences.

(1) The Army NRC licensee will develop a written physical security plan to establish the licensee's overall security strategy. The plan will be developed per 10 CFR 37.43(a).

(2) The Army NRC licensee will develop and maintain written procedures that document how the requirements of this chapter, the security plan, and 10 CFR 37 will be met. The procedures will be developed per 10 CFR 37.43(b).

(3) Security personnel must assist the reviewing official in developing all the enhanced security requirements outlined in chapter 8 of this pamphlet.

b. Facilities, vaults, and containers used for storage of radionuclides of concern are designated a mission essential and vulnerable area and a restricted area in accordance with AR 190-13. Such facilities, vaults, and containers are not to be used for storage of classified material. A vulnerability assessment and risk analysis shall be conducted of the area not less than every 3 years in accordance with AR 190-51 and DA Pam 190-51.

c. Access control measures are implemented to ensure that only those authorized individuals have unescorted access to radionuclides of concern. Access control can be achieved by implementing one or more of the following measures.

(1) Limiting distribution of keys, keycards, access codes, or combination to doors and gates to individuals with unescorted access authorization.

(2) Remote activation of locked doors and gates using remote surveillance.

(3) Using a card reader and electronic locking devices at entry control points.

(4) Constant surveillance by an individual with unescorted access authorization.

*Note.* Keys and locks are controlled in accordance with AR 190-51 and the DOD Key and Lock Program.

d. Constant monitoring is performed to facilitate the immediate detection, assessment, and response to an incident involving a radionuclide of concern. Monitoring may be accomplished by any of the following examples.

(1) A monitored Intrusion Detection System with the capability to detect unauthorized entry and is linked to an on-site or off-site central monitoring facility. Requirements for the intrusion detection system are specified in AR 190-13.

(2) An electronic device for intrusion detection (alarms that alert nearby facility personnel).

(3) A 24-hour surveillance (video surveillance cameras, and visual inspection by trained personnel).

e. Procedures are established for assessing and responding to unauthorized entry or entry attempts so that prompt mitigating measures can be taken. Assessment is accomplished annually by trained personnel who can initiate the appropriate response actions. The procedures address the possibility of simultaneous alarms at multiple locations.

- (1) The Army NRC licensee has a prearranged plan with the local law enforcement agency (LLEA) for assistance.
- (2) The Army NRC licensee ensures that an exercise (can include a tabletop exercise) of the assessment and response procedures is conducted annually, in conjunction with the LLEA.
- (3) In the event of an actual or attempted theft, sabotage, or diversion of radionuclides of concern, the Army NRC licensee ensures that the LLEA is notified immediately, followed soon thereafter by a call to the NRC Operations Center at (301) 816-5100, the appropriate Army NRC license RSO, appropriate Headquarters RSSO, and Army Safety Office (703) 697-1194/1128. Telephone calls to notify the NRC and appropriate Army NRC license RSO should be as prompt as possible, but not at the expense of causing delay or interfering with LLEA response to the event.
  - f. A Category 2 Serious Incident Report will be submitted per AR 190-45 for theft, loss, or recovery of radionuclides of concern or mismanagement of inventory records or assets. Reporting of the theft, loss, or recovery to the Army NRC license RSO will be per chapter 6 of this pamphlet, DA Pam 385-40, and 10 CFR 20.802, and 10 CFR 37.57.
  - g. The Army NRC licensee will have a documented training program for employees on implementation of these measures. The training addresses the access control system employed and notification procedures in the event of unauthorized access and potential malevolent activities. The training shall also include the process for reporting any suspicious activities to security and management. The training and refresher training will be in accordance with 10 CFR 37.43(c).
  - h. The Army NRC licensee ensures that a security program review is conducted annually for content and implementation.
  - i. Refer to 10 CFR 37 Subpart D for specific requirements for transportation of radionuclides of concern, including advance notifications required for Category 1 radioactive materials.

## **Chapter 9 Decommissioning of Facilities**

### **9-1. General**

- a. Each facility that contained unsealed radioactive materials or was contaminated by radioactive materials is to be decommissioned prior to release.
- b. If the radioactive material was NRC-licensed, the facility will be decommissioned in accordance with NRC guidance in NUREG 1757 and NUREG 1575 MARSSIM.
- c. The following sections (9-2 through 9-5) apply for facilities that contained AMC NRC licensed radioactive commodities and for areas that qualify for the simplified guidance in MARSSIM, Appendix B.

### **9-2. Classification for decommissioning purposes**

Army radioactive commodities do not cause contamination during normal use. Therefore, unless contamination is known to exist or is found during surveys, consider facilities that contained only radioactive commodities (and no other radioactive material) to be Group 1 sites as described in NUREG 1757.

### **9-3. Procedure**

- a. Surveys of radioactive commodity facilities that remain under the control of the Army are “routine release surveys” as per guidance in section 9-5.
- b. Otherwise (for example, base realignment and closure sites, formerly used defense sites, foreign sites), surveys are “final status surveys” following the guidance in NUREG 1757 and NUREG 1575 with limitation and conditions as specified.
- c. In cases where contamination of a facility involving a sealed-source radioactive commodity, the alternative simplified survey procedures are used (see NUREG 1757, vol 2).

### **9-4. Typical process for areas that leave Army control**

a. *Radiation safety expertise.* The closing site solicits radiation safety expertise from the applicable licensee to conduct surveys following this guidance. If contamination is expected, contact the AMC NRC commodity license RSO identified in table 6-1 for further direction because the effort requires experienced decommissioning personnel and is beyond the scope of this guidance. However, when no radioactive contamination is expected, the areas are classified as Class 3, and a unit, local, or installation level RSO may be able to perform the final surveys using this guidance and assistance for the radioactive commodity licensees identified in table 6-1. Steps typically include:

- (1) Performing and documenting a Historical Site Assessment (HSA) with approval from the applicable AMC NRC commodity license RSO.
- (2) Formulating survey plans approved by applicable AMC NRC commodity license RSO.

(3) Determinating NRC's default Derived Concentration Guideline Levels (DCGLs) for release of the site for the applicable radioisotopes of concern.

(4) Coordinating survey plans and release limits with the stakeholders.

(5) In the case of OCONUS sites, coordinating survey plans and release limits with the host-nation.

(6) Performing and documenting final surveys.

(7) Filing the HSA and survey results at the unit, installation public works directorates, AMC NRC commodity licensee RSO, AMC RSSO, and ARSO.

(8) Funding for wipe test analysis may be required by the appointed licensed Army lab.

*b. Area classification.* An HSA is conducted to identify areas where NRC licensed or radium containing commodities were stored (long-term), repaired, cannibalized, or buried. A review of the type of operation, as well as any history of accidents, incidents, and leak tests, is used to classify areas. Any routine surveys, as well as any release surveys previously conducted in the area, is also considered for inclusion in the HSA. Commodity areas is classified as follows:

(1) Non-impacted - The following storage areas do not require any surveys. It is necessary to document the areas considered and to justify why no surveys were performed. An example is static storage of sealed sources.

(a) Short-term temporary storage areas.

(b) Where individual item activity did not require posting as a "Radioactive Material" area as per 10 CFR 20.1902(e) which requires posting when radionuclide activity is 10 times the amount in 10 CFR 20.

(c) Where generally licensed smoke detectors, exit signs, and exempt license devices such as advanced combat optical gunsites were stored.

(d) Where a specific NRC licensed condition relieved the "Radioactive Material" posting requirement for bulk storage (for example, less than 1,000 tritium compasses).

(e) Where armored vehicles with intact DU shielding were present.

(f) Where sealed NRC licensed commodities and generally licensed items were present, and leak testing indicated no sealed source leakage. This would include temporary repair, fielding missions.

(2) Class 3 - Most radioactive commodity areas that cannot be classified "Non-impacted" is classified as Class 3. Where historical information indicates an accidental release occurred but has already been cleaned to present day standards, as per NRC Regulatory Guide 1.86 (Reg Guide 1.86) levels for unrestricted release, the area can also be classified as Class 3.

(3) Class 1 and Class 2 - These classifications are for areas where there is known contamination. This would most likely occur in commodity repair and maintenance areas, radioactive waste storage areas, and cannibalization and demilitarization facilities. It might also occur where a commodity was known to have been broken and leaked, and in areas where an accidental release occurred in the past that has not been decontaminated to releasable limits. As stated earlier, when radioactive contamination is expected (Class 1 and Class 2) experienced decommissioning personnel are required, and a rigorous application of MARSSIM beyond the scope of this section is required. Contact the AMC NRC commodity license RSO in table 6-1 for further direction.

*c. Final surveys.*

(1) *Random sampling of building surfaces.* Building surface of concern are the floor and walls to a height of 2 meters above the floor. For Class 3 areas, random sampling is used to eliminate the need for gridding and moving furniture. As permitted by MARSSIM Appendix B and NUREG 1757, thirty (30) random locations can be used to cover each survey unit. A survey unit is an area or group of areas (indoor units not exceeding 2,000 square meters) with a similar history and the same contamination potential. A survey unit can be a room or group of rooms that have the same history of use and contamination potential. If all 30 locations measure below the release limit of Reg Guide 1.86, the MARSSIM statistical tests are not required to demonstrate compliance. An alternate sampling method may be used in accordance with NUREG 1757, volume 2 "simplified survey procedures" for non-leaking sealed sources which allows one area 100 cm<sup>2</sup> wipe per 300 ft<sup>2</sup> in a survey unit. This method is acceptable but must be approved by the applicable AMC NRC commodity license RSO. This survey method significantly reduces the time and cost for the final status survey.

(2) *Wipe testing of building surfaces.* Contact the AMC NRC commodity license RSO identified in table 6-1 to obtain wipe test supplies and instructions. If tritium containing commodities were present, special tritium wipes are required. NUREG 1757, volume 2, "simplified survey procedures" apply.

(3) *Static measurements on building surfaces.* Contact the AMC NRC license RSO identified in table 6-1 for guidance selecting an appropriate instrument and counting mode (count rate vs. integrated count). The level detected at each random location is compared to the level in a "background area," for example, an area of similar construction with no radioactive material or radioactive commodity history. The results are recorded. If any levels noticeably exceeding background are detected, immediately notify the AMC NRC license RSO in table 6-1.

(4) *Scanning.* One hundred percent of all surfaces in the facility are scanned with a thin window pancake-type probe or alpha/beta scintillation probe held within 1 cm of the surface in accordance with NUREG 1757 volume 2, "simplified survey procedures". The alpha emitting and gamma emitting radioactive commodities are subject to periodic leak testing. In the absence of a history of alpha or gamma source leakage, scanning for alpha or gamma radiation is therefore not required. Most of the radioactive commodities that are not periodically leak tested use low



energy beta emitters. Scanning for a low energy beta emitter is not feasible. Scanning will therefore not be required for H-3 (Tritium), Pm-147, or Ni-63 commodities. In the absence of expected or known DU contamination, scanning for DU is not considered feasible. However, if contamination is known or expected to exist in an area, the area will be classified as Class 1 or Class 2, and scanning will be performed as part of a more extensive effort beyond the scope of this section.

(5) *Furniture and equipment.* If the furniture and equipment are still present in an area, they will also be surveyed. The furniture and equipment in a survey unit will likewise be covered with 30 sample locations. Since it is difficult to identify random locations on furniture and equipment with odd shapes, NUREG 1761 recommends the use of biased sampling, for example, locations most likely to be contaminated. This would include the surfaces of tables, shelves, drawers, and so forth that were in direct contact with the commodities. As with the building surfaces, wipe tests and static measurements will be made for each location, and documented. NUREG 1757, volume 2, “simplified survey procedures” will apply.

(6) *Drains, vents, and ducts.* Wipe testing and static measurements of drains, vents, and ducts is not required for Class 3 areas.

(7) *Characterization surveys.* Characterization surveys are not required in Class 3 areas.

(8) *Verification surveys.* Verification surveys are not required in Class 3 areas.

*d. Instrumentation.* Instruments and methods chosen shall be capable of detecting 25 percent of the DCGL for the release of buildings and 50 percent of the DCGL for the release of grounds.

*e. Reporting.* Each unit, local, and installation RSO or tenant RSO notifies the AMC RSSO when a building or area that currently or formerly contained AMC radioactive commodities is scheduled for demolition or will no longer contain AMC radioactive commodities. The AMC RSSO then notifies the AMC NRC commodity license RSO to ensure survey efforts fulfill the requirements of this guidance, and to ensure the NRC is notified as appropriate.

(1) Unless a facility is specifically listed on an NRC license for Class 3 commodity areas (no history of contamination), the NRC does not need to be notified of impending shutdown or change in operational status. The NRC also does not need to be informed that surveys are to be conducted in Class 3 commodity areas, or of the results of the survey, unless contamination is found. Records of the HSA and any surveys performed in a Class 3 commodity area must be filed at the unit, installation, AMC RSSO, and AMC NRC commodity license RSO. This information may be required at a later date to demonstrate to the NRC that the area was properly released.

(2) NRC has advised that notification of the NRC is required when facilities listed in the license contain areas that are expected to be, or are contaminated (Class 1 or Class 2). In this event, within 60 days of a decision to permanently cease commodity activities in such an area, or if no commodity activities have been conducted in such an area for a period of 24 months, the licensee must notify the NRC that the decommissioning process has begun, or within one year submit a decommissioning plan. See 10 CFR 30.36 for further information. To support these efforts, the unit, local, and installation RSO provides the AMC NRC commodity license RSO with the history of past commodity uses, contamination events, commodity inventories, and routine survey records for the areas to be released. It is the responsibility of the AMC NRC license RSO to notify the NRC of decommissioning.

## **9-5. Typical process for areas that will not leave Army control**

Routine release surveys will be required so the area can return to unrestricted use.

*a. Coordinate with regulators.* Coordination with regulators is not required unless required by 9-5e below.

*b. Area classification.* The radioactive commodity area will remain classified as “restricted” until routine release survey results demonstrate compliance with “unrestricted area” contamination levels as defined in NRC regulatory guidance, AR 385-10, this pamphlet, or the conditions of the AMC NRC commodity license.

*c. Routine release surveys.* Formal conduct of the MARSSIM process, to include the HSA, area classification, derivation of DCGLs, and final surveys are not required. The extensive, expensive, and formal process may be required at a later date when transfer of the area from U.S. Army control is planned. But for a routine release survey, the selection of 30 random measurement locations per survey unit for building surfaces and 30 locations for the furniture and equipment in each survey unit is recommended. NUREG 1757, volume 2, “simplified survey procedures” will apply.

*d. Instrumentation.* As a matter of standard practice, instruments and methods chosen for the routine release surveys shall be capable of discerning the release limit in the presence of background radiation.

*e. Reporting.* Each unit, local, and installation RSO and tenant RSO will notify the AMC RSSO when a building or area that currently or formerly contained AMC radioactive commodities is scheduled for demolition or will no longer contain AMC radioactive commodities. The AMC RSSO will then notify the AMC NRC commodity license RSO and ensure the survey efforts fulfill the requirements of this guidance, and to ensure the NRC is notified as appropriate. For Class 3 commodity areas (no history of contamination) the NRC does not need to be notified of impending shutdown or change in operational status. The NRC also does not need to be informed that surveys will be conducted in Class 3 commodity areas, or of the results of the survey unless contamination is found. NRC has advised that notification of the NRC is required when areas are expected to be or are contaminated (Class 1 or Class 2). In this event, within 60 days of a decision to permanently cease commodity activities in such an area, or if no AMC commodity activities have

been conducted in such an area for a period of 24 months, the AMC NRC commodity license RSO must notify the NRC that the decommissioning process has begun, or within one year submit a decommissioning plan. To support these efforts, the unit, local, and installation RSO will be required to provide the AMC NRC commodity license RSO with the history of past commodity uses, commodities used, contamination events, commodity inventories, and routine surveys records for the area to be released.

*f. Recordkeeping.* Each unit, local, and IMCOM RSSO, and commodity-using tenant RSO will maintain decommissioning records of radioactive commodity locations, leakage and contamination incidents, and routine survey results as required by AR 25-400-2.

## **Appendix A References**

### **Section I Required Publications**

#### **AR 25-400-2**

The Army Records Information Management System (ARIMS) (Cited in para para 1-4s(7).)

#### **AR 40-5**

Preventive Medicine (Cited in para para 1-4i(5).)

#### **AR 40-10**

Health Hazard Assessment Program in Support of the Army Acquisition Process (Cited in para 1-4i(4).)

#### **AR 50-7**

Army Reactor Program (Cited in para 2-6c(6).)

#### **AR 70-1**

Army Acquisition Policy (Cited in para 2-3a.)

#### **AR 200-1**

Environmental Protection and Enhancement (Cited in para para 2-3f.)

#### **AR 360-1**

The Army Public Affairs Program (Cited in para para 6-1c.)

#### **AR 385-10**

The Army Safety Program (Cited in para 1-1.)

#### **AR 710-3**

Inventory Management Asset and Transaction Reporting System (Cited in para para 1-4u(6).)

#### **AR 750-43**

Army Test, Measurement, and Diagnostic Equipment (Cited in para 1-4e(4).)

#### **ATP 5-19**

Risk Management (Cited in para 1-4d(3).)

#### **DA Pam 40-11**

Preventive Medicine (Cited in para 2-3a.)

#### **DA Pam 70-3**

Army Acquisition Procedures (Cited in para 2-3a.)

#### **DA Pam 385-16**

System Safety Management Guide (Cited in para 2-3a.)

#### **DA Pam 385-25**

Occupational Dosimetry and Dose Recording for Exposure to Ionizing Radiation (Cited in para para 1-4e(2).)

#### **DA Pam 385-30**

Risk Management (Cited in para 1-4d(3).)

#### **DA Pam 385-40**

Army Accident Investigations and Reporting (Cited in para para 1-4m(10).)

#### **DA Pam 385-63**

Range Safety (Cited in para 3-1e.)

**DOD 4160.21–M–1**

Defense Demilitarization Manual (Cited in para 1-4g(6)(b).) (Available at <http://www.dtic.mil/whs/directives/>.)

**DOD 4500.9–R**

Defense Transportation Regulations (Cited in para 2-18d.) (Available at <http://www.transcom.mil/dtr/dtrHome/>.)

**DODD 4715.11**

Environmental and Explosives Safety Management on Operational Ranges within the United States (Cited in para 2-23a.) (Available at <http://www.dtic.mil/whs/directives/>.)

**DODD 4715.12**

Environmental and Explosives Safety Management on Operational Ranges Outside the United States (Cited in para 2-23a.) (Available at <http://www.dtic.mil/whs/directives/>.)

**DODI 5000.69**

DOD Joint Services Weapon and Laser System Safety Review Processes (Cited in para 1-4d(2)g(iv).) (Available at <http://www.dtic.mil/whs/directives/>.)

**DODI 6055.05**

Occupational and Environmental Health (OEH) (Cited in para para 1-4i(6).) (Available at <http://www.dtic.mil/whs/directives/>.)

**DODI 6055.08**

Occupational Ionizing Radiation Protection Program (Cited in para 1-4d(2)g(i).) (Available at <http://www.dtic.mil/whs/directives/>.)

**DODI 6055.11**

Protecting Personnel from Electromagnetic Field (Cited in para 1-4d(2)g(ii).) (Available at <http://www.dtic.mil/whs/directives/>.)

**DODI 6055.15**

DOD Laser Protection Program (Cited in para 1–4d(2)g(iii).) (Available at <http://www.dtic.mil/whs/directives/>.)

**DODI 6490.03**

Deployment Health (Cited in para 7–4f(1).) (Available at <http://www.dtic.mil/whs/directives/>.)

**TB 43–0133**

Hazard Controls for CECOM Radiofrequency and Optical Radiation Producing Equipment (Cited in para 4–1a.)

**TB 43–0180**

Calibration and Repair Requirements for the Maintenance of Army Material (Cited in para 2–15c.) (Available at [http://www.usamma.amedd.army.mil/assets/docs/TB\\_43–180.pdf](http://www.usamma.amedd.army.mil/assets/docs/TB_43–180.pdf).)

**TB 750–25**

Maintenance of Supplies and Equipment: Army Test, Measurement, and Diagnostic Equipment (TMDE) Calibration and Repair Support (C&RS) Program (Cited in para 1–4e(4).)

**TB MED 523**

Control of Hazards to Health from Microwave and Radio Frequency Radiation and Ultrasound (Cited in para 4–1a.)

**TB MED 524**

Occupational and Environmental Health: Control of Hazards to Health from Laser Radiation (Cited in para 3–1f(1).)

**10 CFR 19.13**

Notifications and reports to individuals (Cited in para 1–4e(2)(d).) (Available at <http://www.ecfr.gov>.)

**10 CFR 31**

General domestic licenses for byproduct material (Cited in para 2–6c(1).) (Available at <http://www.ecfr.gov>.)

**10 CFR 40**

Domestic licensing of source material (Cited in para 2–6c(1).) (Available at <http://www.ecfr.gov>.)

**10 CFR 70**

Domestic licensing of special nuclear material (Cited in para 2–6c(1).) (Available at <http://www.ecfr.gov>.)

**10 CFR 71**

Packaging and transportation of radioactive material (Cited in para 2–18d.) (Available at <http://www.ecfr.gov>.)

**10 CFR 150**

Exemptions and continued regulatory authority in agreement states and in offshore waters under section 274 (Cited in para 2–7b(1)(c).) (Available at <http://www.gpoaccess.gov/cfr/index.html>.)

**21 CFR**

Food and drugs (Cited in para 1–4d(2)(b).) (Available at <http://www.ecfr.gov>.)

**21 CFR 1020.40**

Cabinet x-ray systems (Cited in para 2–7b(4).) (Available at <http://www.ecfr.gov>.)

**29 CFR**

Labor (Cited in para 1–4d(2)(f).) (Available at <http://www.ecfr.gov>.)

**32 CFR 651**

Environmental analysis of Army actions (Cited in para 2–3f.) (Available at <http://www.ecfr.gov>.)

**32 CFR 655**

Radiation sources on Army land (Cited in para 2–3f.) (Available at <http://www.ecfr.gov>.)

**40 CFR**

Protection of environment (Cited in para 1–4d(2)(e).) (Available at <http://www.ecfr.gov>.)

**49 CFR**

Transportation (Cited in para 1–4d(2)(f).) (Available at <http://www.ecfr.gov>.)

**Section II**

**Related Publications**

A related publication is a source of additional information. The user does not have to read it to understand this pamphlet.

**AR 11–2**

Managers' Internal Control Program

**AR 11–34**

The Army Respiratory Protection Program

**AR 25–30**

The Army Publishing Program

**AR 25–55**

The Department of the Army Freedom of Information Act Program

**AR 40–13**

Radiological Advisory Medical Teams

**AR 40–66**

Medical Record Administration and Health Care Documentation

**AR 50–5**

Nuclear Surety

**AR 190–11**

Physical Security of Arms, Ammunitions, and Explosives

**AR 190–13**

The Army Physical Security Program

**AR 190–45**

Law Enforcement Reporting

**AR 190–51**

Security of Unclassified Army Property (Sensitive and Nonsensitive)

**AR 190–56**

The Army Civilian Police and Security Guard Program

**AR 340–21**

The Army Privacy Program

**AR 380–67**

Personnel Security Program

**AR 385–63**

Range Safety

**AR 725–50**

Requisitioning, Receipt, and Issue System

**AR 735–5**

Property Accountability Policies

**DA Pam 50–5**

Nuclear Accident or Incident Response and Assistance (NAIRA) Operations

**DA Pam 190–51**

Risk Analysis for Army Property

**ADP 5–0**

The Operations Process

**ANSI/HPS N2.1–2013**

Radiation Symbol (Available at <http://global.ihs.com/standards.cfm?publisher=HPS&rid=HPS>, free for Health Physics Society Members.)

**ANSI N13.12**

Surface and Volume Radioactivity Standards for Clearance (Available at <http://global.ihs.com>, free for Health Physics Society Members.)

**ANSI N13.30**

Performance Criteria for Radiobioassay (Available at <http://global.ihs.com>, free for Health Physics Society Members.)

**ANSI N43.1**

Radiological Safety for the Design and Operation of Particle Accelerators. (Available at <http://global.ihs.com>, free for Health Physics Society Members.)

**ANSI N43.2**

Radiation Safety for X-Ray Diffraction and Fluorescence Analysis Equipment (Available at <http://global.ihs.com>, free for Health Physics Society Members.)

**ANSI N43.3**

General Radiation Safety Standard—Installations Using Non-Medical X-Ray and Sealed Gamma-Ray Sources, Energies Up to 10 MeV (Available at <http://global.ihs.com>, free for Health Physics Society Members.)

**ANSI N43.17**

Radiation Safety for Personnel Security Screening Systems Using X-rays or Gamma Radiation (Available at <http://global.ihs.com>, free for Health Physics Society Members.)

**ANSI N323**

Radiation Protection Instrumentation Test and Calibration (Available at <http://ansi.org>.)

**ANSI Z136.1**

Safe Use of Lasers (Available at <https://www.lia.org>.)

**ANSI Z136.3**

Safe Use of Lasers in Health Care Facilities (Available at <https://www.lia.org>.)

**ANSI Z136.6**

Safe Use of Lasers Outdoors (Available at <https://www.lia.org>.)

**AST-1500Z-100-93**

Identification Guide for Radioactive Sources in Foreign Materiel (Available at <https://cecomsafety.apg.army.mil>.)

**Atomic Energy Act of 1954, Title 1**

Special Nuclear Material (Available at <http://www.nrc.gov>.)

**DLAI 4145.8/NAVSUPINST 4000.34C/AFJI 23-504/MCO P4400.105**

Material Management for radioactive Items in the DOD (Available at <https://acc.dau.mil>.)

**International Air Transport Association, Section 10**

Dangerous Goods Regulation (Available at <http://www.iata.org/>.)

**IEEE C95.1**

Institute of Electrical and Electronics Engineers, Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz (Available at <http://standards.ieee.org>.)

**IEEE C95.1-2345**

Military Workplaces—Force Health Protection Regarding Personnel Exposure to Electric, Magnetic, and Electromagnetic Fields, 0Hz to 300GHz (Available at <http://standards.ieee.org>.)

**IEEE C95.2**

Institute of Electrical and Electronics Engineers, Standard for Radio-Frequency Energy and Current-Flow Symbols (Available at <http://standards.ieee.org>.)

**IEEE C95.3**

Institute of Electrical and Electronics Engineers, Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields- RF and Microwave (Available at <http://standards.ieee.org>.)

**IEEE C95.6**

Institute of Electrical and Electronics Engineers, Standard for Safety Levels with Respect to Human Exposure to Electromagnetic Fields, 0-3 kHz (Available at <http://standards.ieee.org>.)

**IEEE C95.7**

Institute of Electrical and Electronics Engineers, Recommended Practice for Radio Frequency Safety Programs, 3 kHz to 300 GHz (Available at <http://standards.ieee.org>.)

**Joint Publication 3-11**

Operations in Chemical, Biological, Radiological, and Nuclear Environments (Available at [http://www.dtic.mil/doctrine/new\\_pubs/jp3\\_11.pdf](http://www.dtic.mil/doctrine/new_pubs/jp3_11.pdf).)

**MIL–HDBK–828B**

Range Laser Safety (Available at [https://cecomsafety.apg.army.mil/RSO2/tbmttrs/hbk\\_laser.pdf](https://cecomsafety.apg.army.mil/RSO2/tbmttrs/hbk_laser.pdf).)

**MIL–STD–129**

Military Marking for Shipping and Storage (Available at <http://www.acq.osd.mil/log/sci/ait/MIL–STD–129PCH4.pdf>.)

**MIL–STD 1425A**

DOD Design Criteria Standard, Safety Design Requirements for Military Lasers and Associated Support Equipment (Available at <http://www.navsea.navy.mil>.)

**NCRP Report 123**

Screening Models for Releases of Radionuclides to the Atmosphere, Surface Water and Ground (Available at [http://www.ncrponline.org/Publications/Press\\_Releases/123press.html](http://www.ncrponline.org/Publications/Press_Releases/123press.html).)

**NRC Directive 8.10 and Handbook 8.10**

NRC Medical Event Assessment Program (Available at <http://pbadupws.nrc.gov/docs/ML0414/ML041410592.pdf>.)

**NRC Regulatory Guide 1.86**

Termination of Operating Licenses for Nuclear Reactors (Available at <http://pbadupws.nrc.gov/docs/ML0037/ML003739563.pdf>.)

**NRC Regulatory Guide 8.10**

Operating Philosophy for Maintaining Occupational Radiation Exposures As Low As Is Reasonably Achievable (Available at <http://pbadupws.nrc.gov/docs/ML0037/ML003739563.pdf>.)

**NRC Regulatory Guide 8.13**

Instruction Concerning Prenatal Radiation Exposure (Available at <http://pbadupws.nrc.gov/docs/ML1306/ML13064A087.pdf>.)

**NRC Regulatory Guide 8.29**

Instruction Concerning Risks from Occupational Radiation Exposure (Available at <http://pbadupws.nrc.gov>.)

**NUREG 1505, Rev 1**

A Nonparametric Statistical Methodology for the Design and Analysis of Final Status Decommissioning Surveys - Interim Draft Report for Comment and Use (Available at <http://www.nrc.gov>.)

**NUREG 1507**

Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminates and Field Conditions (Available at <http://pbadupws.nrc.gov>.)

**NUREG 1556**

Consolidated Guidance about Materials Licenses, Volumes 1–21 (Available at <http://www.nrc.gov>.)

**NUREG 1575**

Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) (Available at <http://www.nrc.gov>.)

**NUREG 1757**

Consolidated Decommissioning Guidance, Volumes 1–3 (Available at <http://www.nrc.gov>.)

**NUREG 1761**

Radiological Surveys for Controlling Release of Solid Materials-Draft Report for Comment (Available at <http://www.nrc.gov>.)

**NUREG 2155**

Implementation Guidance for 10 CFR Part 37, “Physical Protection of Category 1 and Category 2 Quantities of Radioactive Material” (Available at <http://www.nrc.gov>.)

**OSHA Directive, CPL 02–00–086 – CPL 2.86**

Memorandum of Understanding between the OSHA and the U.S. Nuclear Regulatory Commission (Available at <https://www.osha.gov/>.)



**OSHA 1910.1096**

Toxic and Hazardous Substances - Ionizing radiation (Available at <https://www.osha.gov/>.)

**OTSG Policy Memo, dated 11 April 1994**

Surveillance of Laser and Radio frequency Radiation Personnel (Available at <http://phc.amedd.army.mil/Pages/default.aspx>.)

**Public Law 93-438**

Energy Reorganization Act of 1974 (Available at <http://www.uscode.gov>.)

**TB 9-665-285-24**

Army Calibration Program for RADIAC Meters (Available at <http://www.logsa.army.mil>.)

**TB 43-0116**

Identification of Radioactive Items in the Army

**TB 43-0137**

Transportation Information for U.S. Army Radioactive Commodities

**TB 43-0197**

Instructions for Safe Handling, Maintenance, Storage, and Transportation of Radioactive Items Under License 12-00722-06

**TB 43-0216**

Safety and Hazard Warnings for Operation and Maintenance of TACOM Equipment

**TB 385-4**

Safety Requirements for Maintenance of Electrical and Electronic Equipment

**TB MED 521**

Occupational and Environmental Health: Management and Control of Diagnostic, Therapeutic, and Medical Research X-Ray Systems and Facilities

**TB MED 522**

Control of Health Hazards from Radioactive Material Used in Self-Luminous Devices

**TB MED 525**

Control of Hazards to Health from Ionizing Radiation Used by the Army Medical Department

**TM 3-261**

Handling and Disposal of Unwanted Radioactive Material

**Technical Report 94-11**

Radiation Protection Information for the Safe Handling of Tritium Sources in Radioluminescent Devices (Available at the National Ground Intelligence Center (IANG-TCN) 220 7th St, NE, Charlottesville, VA 22902-5396.)

**10 CFR**

Energy (Available at <http://www.gpo.gov>.)

**10 CFR, Chapter 1**

Nuclear Regulatory Commission (Available at <http://www.gpo.gov>.)

**10 CFR 20, Appendix B**

Annual limits on intake (ALIs) and derived air concentrations (DACs) of radionuclides for occupational exposure; effluent concentrations; concentrations for release to sewerage (Available at <http://www.nrc.gov>.)

**10 CFR 20.1003**

Definitions (Available at <http://www.nrc.gov>.)

**10 CFR 20.1004**

Units of radiation dose (Available at <http://www.nrc.gov>.)

**10 CFR 20.1301**

Dose limits for individual members of the public (Available at <http://www.nrc.gov>.)

**10 CFR 20.1501**

General (Available at <http://www.nrc.gov>.)

**10 CFR 20.2106**

Records of individual monitoring results (Available at <http://www.nrc.gov>.)

**10 CFR 20.2110**

Form of records (Available at <http://www.nrc.gov>.)

**10 CFR 20.2201**

Reports of theft or loss of licensed material (Available at <http://www.nrc.gov>.)

**10 CFR 20.2205**

Reports of individuals of exceeding dose limits (Available at <http://www.nrc.gov>.)

**10 CFR 20.2206**

Reports of individual monitoring (Available at <http://www.nrc.gov>.)

**10 CFR 30.5**

Interpretations (Available at <http://www.nrc.gov>.)

**10 CFR 30.14**

Exempt concentrations (Available at <http://www.nrc.gov>.)

**10 CFR 30.18**

Exempt quantities (Available at <http://www.nrc.gov>.)

**10 CFR 30.20**

Gas and aerosol detectors containing by- product material (Available at <http://www.nrc.gov>.)

**10 CFR 30.35**

Financial assurance and recordkeeping for decommissioning (Available at <http://www.nrc.gov>.)

**10 CFR 30.36**

Expiration and termination of licenses and decommissioning of sites and separate buildings or outdoor areas. (Available at <http://www.nrc.gov>.)

**10 CFR 37**

Physical protection of category 1 and category 2 quantities of radioactive material (Available at <http://www.nrc.gov>.)

**10 CFR 37.23**

Access authorization program requirements (Available at <http://www.nrc.gov>.)

**10 CFR 37.25**

Background investigations (Available at <http://www.nrc.gov>.)

**10 CFR 37.31**

Protection of information (Available at <http://www.nrc.gov>.)

**10 CFR 37.43**

General security program requirements (Available at <http://www.nrc.gov>.)

**10 CFR 37.57**

Reporting of events (Available at <http://www.nrc.gov>.)

**10 CFR 40.11**

Persons using source material under certain Department of Energy and Nuclear Regulatory Commission contracts. (Available at <http://www.nrc.gov>.)

**10 CFR 40.13**

Domestic licensing of source material-unimportant quantities of source material (Available at <http://www.nrc.gov>.)

**10 CFR 40.36**

Domestic licensing of source material-financial assurance and recordkeeping for decommissioning (Available at <http://www.nrc.gov>.)

**10 CFR 61**

Licensing requirements for land disposal of radioactive waste (Available at <http://www.nrc.gov>.)

**10 CFR 62**

Criteria and procedures for emergency access to non-Federal and regional low-level waste disposal facilities (Available at <http://www.nrc.gov>.)

**10 CFR 70**

Domestic licensing of special nuclear material (Available at <http://www.nrc.gov>.)

**10 CFR 70.19**

Domestic licensing of special nuclear material-General license for calibration or reference sources (Available at <http://www.nrc.gov>.)

**10 CFR 70.25**

Domestic licensing of special nuclear material-Financial assurance and recordkeeping for decommissioning (Available at <http://www.nrc.gov>.)

**10 CFR 110, Appendix P**

Export and import of nuclear equipment and material, appendix P category 1 and 2 radioactive material (Available at <http://www.nrc.gov>.)

**10 CFR 150.20**

Recognition of agreement state licenses (Available at <http://www.nrc.gov>.)

**10 CFR 835**

Occupational radiation protection (Available at <http://www.gpo.gov>.)

**21 CFR 1002**

Records and reports (Available at <http://www.gpo.gov>.)

**21 CFR 1020**

Performance standards for ionizing radiation emitting products (Available at <http://www.gpo.gov>.)

**21 CFR 1040**

Performance standards for light-emitting products (Available at <http://www.gpo.gov>.)

**21 CFR 1040.10**

Laser products (Available at <http://www.gpo.gov>.)

**21 CFR 1040.11**

Specific purpose laser products (Available at <http://www.gpo.gov>.)

**29 CFR 1910.1096**

Ionizing radiation (Available at <http://www.gpo.gov>.)

**29 CFR 1926.53**

Ionizing radiation (Available at <http://www.gpo.gov>.)

## **29 CFR 1926.54**

Nonionizing radiation (Available at <http://www.gpo.gov>.)

## **49 CFR 173.1**

Purpose and scope (Available at <http://www.gpo.gov>.)

### **Section III**

#### **Prescribed Forms**

Unless otherwise indicated below, DA forms are available on the Army Publishing Directorate Web site (<http://www.apd.army.mil/>) .

#### **DA Form 3337**

Application for Army Radiation Authorization (Prescribed in para 2–6e(1).)

### **Section IV**

#### **Referenced Forms**

Unless otherwise indicated, DA forms are available on the Army Publishing Directorate Web site (<http://www.apd.army.mil/>)

#### **DA Form 285–AB**

U.S. Army Abbreviated Ground Accident Report

#### **DA Form 2028**

Recommended Changes to Publications and Blank Forms

#### **NRC Form 241**

Report of Proposed Activities in Non-Agreement States, Areas of Exclusive Federal Jurisdiction or Offshore Waters (Available at <http://www.nrc.gov>.)

## **Appendix B**

### **Annual Radiation Safety Audit Checklist**

#### **B–1. Function**

The function covered by this checklist is radiation safety.

#### **B–2. Purpose**

The purpose of this checklist is to assist commanders/directors and RSOs in evaluating the key program elements listed below. It is not intended to cover all aspects of the program.

#### **B–3. Instructions**

Answers must be based on the actual testing of key program elements (for example, document analysis, direct observation, sampling, and simulation). Answers that indicate deficiencies must be explained and corrective action indicated in supporting documentation. These questions are the minimum used to adequately assess a radiation safety program for the annual audit. However, some questions may not apply to a specific program and may be rated as not applicable or N/A.

#### **B–4. Checklist questions**

- a.* If required has a person been designated in writing to be RSO? Has the RSO been trained (chapter 7)?
- b.* If required has a written radiation safety SOP been established?
- c.* Are all personnel occupationally exposed to radiation receiving radiation safety training?
- d.* Are all radiation sources secured against unauthorized use and removal?
- e.* Are all controllable quantities of radioactive material and radiation-producing sources held by the unit under appropriate authority (for example, an NRC license, an Army radiation authorization, or as part of a radioactive commodity)?
- f.* Is all radioactive waste disposed of properly?
- g.* Are all radiation survey instruments used for health and safety appropriately calibrated?
- h.* For Army laser ranges, have all type-classified or commercial Class 3B or Class 4 lasers received appropriate evaluation before their use?

- i.* Are all unwanted military-exempt lasers disposed of properly?
- j.* Are all accidents and incidents involving personnel radiation exposure or radioactive contamination of facilities, equipment, or the environment, or loss of radioactive materials promptly reported through appropriate channels?
- k.* Do all personnel occupationally exposed to ionizing radiation or radioactive material above applicable levels participate in an appropriate dosimetry or bioassay program?
- l.* Is the dose in all unrestricted areas less than 2 millirems (0.02 millisieverts) in any one hour?
- m.* Are historical records on hand for licenses, ARA, ARP, disposal, and personnel exposures?
- n.* Are radiation surveys and leak tests performed at the prescribed interval?
- o.* Is there a need for an RSC and is it meeting the intent?
- p.* Is there an environmental impact based on the impact of the radiation safety program?
- q.* Are inventories of radioactive materials being completed at required intervals?
- r.* Are EMF sources that need a radiation safety program being inventoried at required intervals?
- s.* Are the NRC posting requirements being met and are emergency contact numbers posted conspicuously?

## **Glossary**

### **Section I Abbreviations**

**ACOM**

Army command

**ACSIM**

Assistant Chief of Staff for Installation Management

**ADC**

U.S. Army Dosimetry Center

**ALARA**

as low as reasonably achievable

**ALI**

Annual Limit of Intake

**AMC**

U.S. Army Materiel Command

**AMCOM**

U.S. Army Aviation and Missile Command

**ANSI**

American National Standards Institute

**AR**

Army Regulation

**ARA**

Army radiation authorization

**ARIMS**

Army Records Information Management System

**ARNG**

Army National Guard

**ARP**

Army radiation permit

**ARSC**

Army Radiation Safety Council

**ARSO**

Army Radiation Safety Officer

**ASA (IE&E)**

Assistant Secretary of the Army (Installations, Energy and Environment)

**ASA (M&RA)**

Assistant Secretary of the Army (Manpower and Reserve Affairs)

**ASCC**

Army service component command

**CEDE**

committed effective dose equivalent

**CECOM LCMC**  
U.S. Army CECOM Life Cycle Management Command

**CFR**  
Code of Federal Regulations

**CG**  
commanding general

**CONUS**  
continental United States

**CSA**  
Chief of Staff, Army

**cm**  
centimeter

**DA**  
Department of the Army

**DASAF**  
Director of Army Safety

**DOD**  
Department of Defense

**DODI**  
Department of Defense instruction

**DOE**  
Department of Energy

**DOT**  
Department of Transportation

**DRU**  
direct reporting unit

**DSN**  
Defense Switched Network

**DU**  
depleted uranium

**ED**  
effective dose

**EMR**  
electromagnetic radiation

**EPA**  
Environmental Protection Agency

**eV**  
electron volt

**FDA**  
Food and Drug Administration

**FM**

field manual

**FORSCOM**

U.S. Army Forces Command

**GHz**

gigahertz

**GOCO**

Government-owned contractor-operated

**HDBK**

handbook

**HQDA**

Headquarters, Department of the Army

**Hz**

Hertz

**IEEE**

Institute of Electrical and Electronics Engineers

**IMCOM**

U.S. Army Installation Management Command

**IR**

infrared

**JMC**

Joint Munitions Command

**kHz**

kilohertz

**km**

kilometer

**laser**

light amplification by stimulated emitted radiation

**LCMC**

Life Cycle Management Command

**LSO**

laser safety officer

**m**

meter

**MEDCOM**

U.S. Army Medical Command

**mg**

milligram

**MIL**

military



**MHz**

megahertz

**mm**

millimeter

**mrad**

millirad

**MSC**

major subordinate command

**NCRP**

National Council on Radiation Protection and Measurements

**NGB**

National Guard Bureau

**nm**

nanometer

**NRC**

U.S. Nuclear Regulatory Commission

**NUREG**

U.S. Nuclear Regulatory Commission Regulation

**NVLAP**

National Voluntary Laboratory Accreditation Program

**OCONUS**

outside the continental United States

**OSHA**

Occupational Safety and Health Administration

**OTSG**

Office of The Surgeon General

**PM**

program manager

**PPE**

personal protection equipment

**PSSS**

Personnel Security Screening Systems

**RAM**

radioactive material

**RF**

radio frequency

**RSC**

Radiation Safety Committee

**RSO**

radiation safety officer

**RSP**

Radiation Safety Program

**RSSO**

radiation safety staff officer

**SI**

Systemé Internationale (International System)

**SOFA**

Status of Forces Agreement

**SOP**

standing operating procedure

**TACOM**

U.S. Army Tank-automotive and Armaments Command

**TB**

technical bulletin

**TB MED**

technical bulletin (medical)

**TM**

technical manual

**TRADOC**

U.S. Army Training and Doctrine Command

**TSG**

The Surgeon General

**U.S.**

United States

**USADC**

U.S. Army Dosimetry Center

**USAR**

U.S. Army Reserve

**UV**

ultraviolet

**Section II****Terms****Absorbed dose**

The energy absorbed from the incident radiation per unit mass of absorbing material. The units of absorbed dose are the rad and the gray (Gy).

**Administrative dose**

The dose that a RSO assigns when dosimetry is inaccurate or has been misused or lost.

**Agreement state**

Any State with which the Atomic Energy Commission or the NRC has entered into an effective agreement in which the State assumes many of the NRC's functions.

**Annual limit of intake**

The derived limit for the amount of RAM taken into the body of an adult worker by inhalation or ingestion in a year.

The annual limit of intake is the smaller value of intake of a given radionuclide in a year that would result in a CEDE of 5 rems (0.05 Sv) or a committed dose equivalent of 50 rems (0.5 Sv) to any organ or tissue.

**Army command**

An Army force, designated by the Secretary of the Army, performing multiple Army Service Title 10 functions across multiple disciplines. Command responsibilities are those established by the Secretary. The ACOMs are U.S. Army Force Command (FORSCOM), TRADOC, and AMC.

**Army National Guard facilities**

Pertains to those facilities normally employed for the administration and training of Army National Guard units, in any entire structure or part thereof, including any interest in land, armories, and storage and other use areas.

**Army Regulation**

A directive that sets forth missions, responsibilities, and policies, and establishes procedures to ensure uniform compliance with those policies.

**Army Reserve facilities**

Pertains to those facilities normally employed for the administration and training of Army Reserve units, in any entire structure or part thereof, including any interest in land, Army Reserve Center, and storage and other use areas.

**Army service component command**

The ASCC is the Army component of a combatant command.

**As low as is reasonably achievable**

Making every reasonable effort to maintain exposures to radiation as far below applicable dose limits as is practically consistent with the purpose for which the activity is undertaken, taking into account the 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 utilization of nuclear energy, RAMs, and ionizing radiation in the public interest.

**Background radiation**

Radiation from cosmic sources; naturally occurring radioactive material including radon (except as a decay product of source or special nuclear material, or when workplace radon levels require compliance with 29 CFR 1910.1096); and global fallout as it exists in the environment from the testing of nuclear explosive devices or from past nuclear accidents such as Chernobyl that contribute to background radiation. Background radiation does not include radiation from the source, byproduct, or special nuclear materials that the NRC regulates or from NARM that the Army regulates.

**Becquerel**

The SI unit of radioactivity equivalent to one nuclear transformation per second.

**Bioassay (radiobioassay) T**

The determination of kinds, quantities or concentrations, and, in some cases, the locations of RAM in the human body, whether by direct measurement (in vivo counting) or by analysis and evaluation of materials excreted or removed from the human body (in vitro counting).

**By-product material**

Any RAM (except special nuclear material) yielded in or made radioactive by exposure to the radiation incident to the process of producing or utilizing special nuclear material.

**Committed dose equivalent**

The dose equivalent to organs or tissue of reference that will be received from an intake of RAM 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.

**Commodity, radioactive**

See radioactive commodity.

**Condition**

The status of personnel and equipment (readiness) as they interact with the operational environment during mission planning and execution.

**Control**

Action taken to eliminate hazards or reduce their risk.

**Curie**

A unit of radioactivity equal to 37 billion becquerels.

**Declared pregnant woman**

A woman who has voluntarily informed her employer, in writing, of her pregnancy and the estimated date of conception, for the purpose of radiation protection of the developing fetus.

**Decommission**

To remove (as a facility) safely from service and reduce residual radioactivity to a level that permits release of the property for unrestricted use and termination of the NRC license, Army reactor permit, or Army radiation authorization.

**Deep-dose equivalent**

Applies to external whole-body exposure and is the dose equivalent at a tissue depth of 1 centimeter (1000 mg/cm<sup>2</sup>).

**Derived air concentration**

The concentration of a given radionuclide in air that, if breathed for a working year of 2,000 hours under conditions of light work (inhalation rate 1.2 cubic meters of air per hour) results in an inhalation of one ALI.

**Deviation**

A departure from the requirements of this pamphlet.

**Dose equivalent**

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

**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. The units of dose equivalent are the rem and Sv.

**Electromagnetic radiation**

Electric and magnetic fields that oscillate at right angles to each other and to their direction of propagation and that travel at the speed of light in a vacuum (300,000 kilometers per second). Electromagnetic radiation includes gamma rays, x-rays, ultraviolet radiation, visible light, infrared radiation, RF radiation, and extremely low frequency EMR (see table 5-3).

**Electron volt**

A unit of energy equal to  $1.6 \times 10^{19}$  joule.

**Exposure**

The frequency and length of time subjected to a hazard.

**Extremely low frequency electromagnetic radiation**

Electromagnetic radiation with a frequency less than 3 kHz.

**Eye dose equivalent**

Applies to the external exposure of the lens of the eye and is taken as the dose equivalent at a tissue depth of 0.3 centimeters (300 mg/cm<sup>2</sup>).

**Garrison**

The garrison is a table of distribution allowance organization that operates the installation and provides base operations services to tenant organizations. The garrison normally belongs to the IMCOM.

**Gigahertz**

An SI unit prefix indicating a factor of one billion ( $1 \times 10^9$ ).

**Gray**

The SI unit of absorbed dose. One gray is equal to an absorbed dose of 1 joule/kilogram (100 rads).

**Hazard**

Any real or potential condition that can cause injury, illness, death of personnel, damage to or loss of equipment or property, or mission degradation.

**Hertz**

The SI unit of frequency equivalent to one vibration (cycle) per second.

**High radiation area**

An area, accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 100 mrem (1 mSv) in 1 hour at 30 centimeters from the radiation source or from any surface that the radiation penetrates.

**Infrared electromagnetic radiation**

Electromagnetic radiation with a wavelength between 760–780 nm and 1 mm.

**Installation**

An aggregation of contiguous or near contiguous, common mission-supporting real property holdings under the jurisdiction of DOD or a state, the District of Columbia, territory, commonwealth, or possession, controlled by and at which an Army unit or activity (active, USAR, or ARNG) is permanently assigned.

**Ionizing radiation**

Charged subatomic particles and ionized atoms with kinetic energies greater than 12.4 eV, EMR with photon energies greater than 12.4 eV, and all free neutrons and other uncharged subatomic particles (except neutrinos and antineutrinos).

**Kilo**

SI units prefix indicating a factor of 1000.

**Light amplification by stimulated emission of radiation (laser)**

A laser is a device that produces an intense, coherent, directional beam of light by stimulating electronic or molecular transitions to higher energy levels. Lasers are classified by the degree of potential hazard (see 21 CFR 1040.10 and ANSI Z136.1 for comprehensive definitions of laser hazard classes).

*a.* Class 1 lasers emit at levels that are not hazardous under any viewing or maintenance conditions. They are exempt from control measures. (However, as a matter of good safety practices avoid intrabeam viewing in case the laser is mislabeled.)

*b.* Class 2 lasers (low-power) emit in the visible light portion of the electromagnetic spectrum. They are a potential eye hazard only for prolonged intrabeam viewing. Eye protection is normally afforded by the aversion response including the blink reflex.

*c.* Class 3 (medium-power) lasers emit in the IR, visible, or ultraviolet portions of the electromagnetic spectrum. They are a hazard for direct intrabeam and specular reflection viewing. Diffuse reflection is not normally a hazard.

(1) Class 3a lasers, even though they emit at Class 3 power levels, have special beam characteristics that make them eye-safe except when viewed through magnifying optics.

(2) Class 3b lasers are all other Class 3 lasers. Class 3b laser devices are potentially hazardous if the unprotected eye views the direct or specularly reflected beam, but they normally do not cause hazardous diffuse reflections.

*d.* Class 4 (high-power) lasers emit in the IR, visible, or ultraviolet portions of the electromagnetic spectrum. They are hazardous for direct intrabeam exposure and sometimes diffuse reflection exposure to the eyes or skin. They may also produce fire, material damage, laser generated air contaminants, and hazardous plasma radiation.

**Low-level radioactive waste**

See radioactive waste, low-level.

**Materiel subordinate command**

A major subordinate command of the AMC responsible for National Inventory Control Point and National Maintenance Point functions for assigned items (see AR 725–50).

**Member of the public**

Any individual except when that individual is receiving an occupational dose.

**Micro**

SI units prefix indicating a factor of one one-millionth ( $1 \times 10^6$ ).

**Military-exempt lasers**

Those lasers and laser systems that the FDA has exempted from the provisions of 21 CFR 1040.10 and 21 CFR 1040.11 and of 21 CFR 1002 (except 21 CFR 1002.20) (exemption no. 76-EL-01 DOD). These laser products are used exclusively by DOD components and are designed for actual combat or combat training operations or are classified in the interest of national security.

**Milli**

SI units prefix indicating a factor of one one-thousandth (0.001).

**Naturally occurring or accelerator produced radioactive material**

Radioactive material not classified as a by-product, special, or source material; NARM includes naturally occurring RAM.

**Non-ionizing radiation**

Electromagnetic radiation with photon energies less than 12.4 eV.

**Occupational dose**

The dose received by an individual in the course of employment in which the individual's assigned duties involve exposure to radiation or to RAM from regulated and unregulated sources of radiation, whether in the possession of the employer or another person. Occupational dose does not include dose received from background radiation; from any medical administration the individual has received; from exposure to patients administered RAM and released in accordance with applicable regulations; from voluntary participation in medical research programs; or as a member of the public. Workplace exposure to naturally occurring RAM, such as radon, considered background radiation by NRC may be considered an occupational exposure by OSHA and regulated under 29 CFR 1910.1096.

**Optical radiation**

See visible light.

**Peta**

An SI unit prefix indicating a factor of one million billion ( $1 \times 10^{15}$ ).

**Probability**

The likelihood that an event will occur.

**Qualified expert**

A person who, by virtue of training and experience, can provide competent, authoritative guidance on specific aspects of radiation safety. Being a qualified expert in one aspect of radiation safety does not necessarily mean that a person is a qualified expert in a different aspect. Forward requests for determination of whether a certain individual is a qualified expert through command channels to the Army Headquarters (ACOM, ASCC, DRU)/IMCOM RSSO as necessary. Forward these requests to the Director of Army Safety, DASAF, 9351 Hall Rd, Ft Belvoir, VA 22060, for further evaluation as necessary.

**Quality Factor**

The modifying factor (listed in 10 CFR 20.1004) that is used to derive dose equivalent from absorbed dose.

**Rad**

A unit of absorbed dose. One rad is equal to an absorbed dose of 0.01 joule/kilogram (0.01 gray).

**Radiation**

For the purposes of this pamphlet, unless otherwise specified, the radiation includes both ionizing and non-ionizing radiation.

**Radiation area**

An area, accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in

excess of 0.005 rem (0.05 mSv) in 1 hour at 30 centimeters from the radiation source or from any surface that the radiation penetrates.

### **Radiation safety**

For the purposes of this pamphlet, a discipline whose objective is the protection of people and the environment from unnecessary exposure to radiation. Radiation safety is concerned with understanding, evaluating, and controlling the risks from radiation exposure relative to the benefits derived. Same as “radiation protection.” Health physics has the same objective, but is a scientific discipline.

### **Radiation Safety Committee**

An advisory committee for the commander/director to assess the adequacy of the command’s RSP. Same as “radiation control committee” and “radiation protection committee.”

### **Radiation safety officer**

The person that the commander designates, in writing, as the executive agent for the command’s RSP (same as “radiation protection officer”). These individuals are provided training commensurate with the radiation hazards they manage. Types of RSOs discussed in this pamphlet include:

- a. Garrison RSO.* The RSO on the staff of the garrison commander. The garrison RSO normally belongs to the IMCOM) (For ARNG, the state RSO is considered to be the garrison RSO).
- b. Installation RSO.* The RSO on the staff of the installation commander for arsenals, depots, and similar areas not managed by the IMCOM.
- c. Mission RSO.* The RSO in an “Army Headquarters” activity. The Army Headquarters activity is typically a tenant organization on an installation (synonymous with tenant activity RSO).
- d. Unit RSO.* The RSO in an Army unit (typically a brigade, battalion, company, detachment or TDA organization).

### **Radiation Safety Program**

A program to implement the objective of radiation safety. The ARSP includes all aspects of—

- a.* Measurement and evaluation of radiation and RAM pertaining to the protection of personnel and the environment.
- b.* Army compliance with Federal and DOD, and Army radiation safety regulations.
- c.* The Army’s radiation dosimetry; radiation bioassay; radioactive waste disposal; radiation safety training; and radiation instrument TMDE and calibration programs.

### **Radioactive commodity**

An item of Government property made up in whole or in part of RAM to which a national stock number or part number is assigned. Examples of Army radioactive commodities include tritium fire control devices, chemical agent detectors/monitors, lensatic compasses, DU munitions, radioluminescent sights and gauges on vehicles, and moisture density gauges.

### **Radioactive waste**

Solid, liquid, or gaseous material that contains radionuclides regulated under the Atomic Energy Act, as amended, or is of sufficient quantity to require an ARA, and is of negligible economic value considering the cost of recovery.

### **Radioactive waste, low-level**

Material the NRC classifies as low-level radioactive waste (see 10 CFR 62.2); waste not classified as high-level radioactive waste (spent nuclear fuel), as transuranic waste, or as uranium or thorium tailings and waste; material acceptable for burial in a land disposal facility (see 10 CFR 61).

### **Radiobioassay**

See bioassay.

### **Radiofrequency electromagnetic radiation**

Electromagnetic radiation with frequencies between 3 kHz and 300 GHz.

### **Radiofrequency controlled environment**

Locations where RF exposure may be incurred by persons who are aware of the potential for occupational exposure, by other cognizant persons, or as the incidental result of transient passage through areas where analysis shows the exposure levels may be above those shown in DODI 6055.1, but do not exceed those shown in DODI 6055.1. Existing physical arrangements or areas, such as fences, perimeters, or weather deck(s) of a ship maybe used in establishing a controlled environment.

**Radiofrequency uncontrolled environments**

Locations where RF exposures do not exceed permissible exposure levels in DODI 6055.1. Such locations represent living quarters, workplaces, or public access areas where personnel would not expect to encounter higher levels of RF energy.

**Radiation Safety Committee recorder**

Designee directly responsible for the accuracy and completeness of the RSC minutes. The recorder may designate someone else to take notes at RSC meetings (for example, an assistant or secretary). The recorder will be the RSO to help ensure that the minutes meet regulatory requirements.

**Rem**

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

**Residual risk**

The levels of risk remaining after controls have been identified, and countermeasures have been selected for hazards that may result in loss of combat power. Controls are identified and selected until the residual risk is at an acceptable level or until it cannot be practically reduced any further.

**Restricted area**

An area, access to which is limited by the licensee for the purpose of protecting individuals against undue risks from exposure to radiation and radioactive materials. Restricted area does not include areas used as residential quarters, but separate rooms in a residential building may be set apart as a restricted area.

**Risk**

A measure of the expected loss from a given hazard or group of hazards; the probability of exposure to the possibility of injury or loss from a hazard. Risk level is expressed in terms of hazard probability and severity.

**Risk assessment**

Risk assessment Steps 1 and 2 of the Army's RM Process, identification and assessment of potential loss in terms of hazards. An identified hazard is assessed to determine the risk (both the probability and severity) of an incident due to the presence of the hazard.

*a. Hazard severity.* An assessment of the expected consequence, defined by the degree of injury or occupational illness, property damage or effect on the mission that could occur from a hazard. A hazard is coded by an uppercase Roman numeral according to criteria contained in ATP 5-19.

*b. Accident probability.* An assessment of the likelihood that, given exposure to a hazard, an accident will result. Accident probability is coded by an uppercase letter according to criteria contained in ATP 5-19.

**Risk acceptance**

The decision to accept or not accept the risk(s) associated with an action; made by the commander, leader, or individual responsible for performing that action and having the appropriate resources to control or eliminate the risk's associated hazard.

**Risk management integration**

The embedding of risk management principles and practices into Army operations, culture, organizations, systems, and individual behavior.

**Severity**

The expected consequence of an event (hazardous incident) in terms of degree of injury, property damage, or other mission impairing factors (loss of combat power and so on) that could occur.

**Shallow dose equivalent**

Applies to the external exposure of the skin or an extremity and is taken as the dose equivalent at a tissue depth of 0.007 centimeters ( $7 \text{ mg/cm}^2$ ) averaged over an area of 1 square centimeter.

**Short course**

For the purpose of this pamphlet, a course of three weeks duration or less based on the training developers determination of the precise length of courses.



**Sievert**

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 rem).

**Source material**

Uranium or thorium, or any combination thereof, in any physical or chemical form or ores that contain by weight one-twentieth of one percent (0.05%) or more of uranium, thorium, or any combination thereof. Source material does not include special nuclear material.

**Special nuclear material**

Plutonium, uranium-233, uranium enriched in the isotope 233 or in the isotope 235, or any material artificially enriched by any of the foregoing.

**Tera**

An SI unit prefix indicating a factor of one trillion ( $1 \times 10^{12}$ ).

**Total effective dose equivalent**

The sum of the deep-dose equivalent (for external exposures) and the CEDE (for internal exposures).

**Type classification**

A designation the Army uses to indicate acceptability for service use.

**Ultraviolet electromagnetic radiation**

Electromagnetic radiation with wavelengths between 100 nm and 380–400 nm.

**Unrestricted area**

An area, access to which is neither limited nor controlled (for the purposes of ionizing radiation safety).

**Very high radiation area**

An area, accessible to individuals, in which radiation levels could result in an individual receiving an absorbed dose in excess of 500 rads (5 Gy) in 1 hour at 1 meter from a radiation source or from any surface that the radiation penetrates.

**Visible light**

Electromagnetic radiation with wavelengths between 380–400 nm and 760–780 nm.

**Weighting factor**

For an organ or tissue, the proportion of the risk of stochastic effects resulting from irradiation of that organ or tissue to the total risk of stochastic effects when the whole body is irradiated uniformly.

**Section III****Special Abbreviations and Terms****ARSP**

Army Radiation Safety Program

**Bq**

Becquerel

**CDRR**

Central Dosimetry Records Repository

**Ci**

Curie

**CIE**

International Commission on Illumination

**DCGL**

derived concentration guideline

**DDE**

deep dose equivalent

**dpm**

disintegrations per minute

**EDE**

effective dose equivalent

**EMF**

electromagnetic field

**ERL**

exposure reference levels

**Gy**

Gray

**HP**

Health physicist

**HSA**

Historical site assessment

**kBq**

kilobecquerel

**LLEA**

local law enforcement agency

**MARSSIM**

Multi-Agency Radiation Survey and Site Investigation Manual

**mCi**

millicurie

**μCi**

microcurie

**μm**

micrometer

**mrem**

millirem

**mSv**

millisievert

**NARM**

naturally occurring or accelerator produced radioactive materials

**PHz**

petahertz

**RFSO**

radiofrequency safety officer

**RSP**

Radiation Safety Program

**SDE**

shallow dose equivalent

**Sv**

sievert

**TBq**

terabequerels

**THz**

terahertz

**USPHC**

U.S. Army Public Health Command

**UNCLASSIFIED**

**PIN 083958-000**