

Safety
Ionizing and Nonionizing Radiation Protection Program

History. This regulation supersedes Fort Hood Regulation 385-11, dated 15 September 1995.

Summary. This regulation outlines the control, handling, storage, and disposal of ionizing and nonionizing radiation producing devices.

Applicability. This regulation applies to commands, contractors, tenant units, and activities assigned, attached, or supported by III Corps at Fort Hood. This also applies to non-medical material and equipment producing ionizing radiation. The Commander, Fort Hood Medical Department Activity

(MEDDAC) administers radiation protection services for tenant medical and dental activities.

Supplementation. Local supplementation of this regulation is prohibited unless approved by the III Corps Assistant Chief of Staff (ACoS), G1, Safety Office.

Suggested Improvements. The proponent for this regulation is III Corps, ACoS, G1 Safety. Users are invited to send comments and suggested improvements by memorandum to Commander, III Corps, ATTN: AFZF-GA-SAFE-G, Fort Hood, Texas 76544-5000.

FOR THE COMMANDER:

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OVERVIEW

1

Purpose This regulation provides policy, responsibilities, procedures, and information necessary for the control, handling, storage, and disposal of ionizing and nonionizing radiation producing devices. 1a

Abbreviations and Terms The glossary explains abbreviations and terms. 1b

References Appendix A lists required and related references. 1c

POLICY

2

As Low As Is Reasonably Achievable (ALARA) Personnel involved in radiation work, including storage, shipment or disposal of radioactive items will follow the ALARA philosophy; reducing operation exposure levels to an absolute minimum. Appendix B outlines radiation protection standards. 2a

Shipments The Installation Radiation Safety Officer (IRSO) monitors outgoing and incoming shipments of radioactive items or packages for correct

- Packaging.
- Markings and labels.
- Radiation levels.

Wipe-test shipments, as required. 2b

Disposition of Radioactive Waste Dispose of radioactive waste through the IRSO.

- Under no circumstances will radioactive waste be disposed of improperly.

The IRSO will demilitarize radioactive equipment.

Wear personal protective equipment (PPE) if required by an applicable regulation, activity standing operating procedure (SOP), or equipment TM.

Wear film badges, or Thermo-luminescent Dosimeters (TLDs), when working in radiation areas that require their use.

Wear dosimeters when working with an individually controlled radioactive item, an x-ray emitting device, or any item so specified by DA, or the Nuclear Regulatory Commission (NRC). 2c

**Installation
Radiation
Control
Committee
(IRCC)**

The IRCC is organized according to AR 11-9 (Ionizing Radiation Protection).

The IRCC:

- Reviews radiation safety actions, procedures, and issues.
- Convenes annually, or when called by the chairperson.
- Publishes minutes of meetings.
- Reviews proposals to use or get radioactive items at Fort Hood.
- Review regulatory changes.
- Recommends policy improvements concerning local procedures.
- Establishes local rules and procedures for safe storage, procurement, and use of radioactive sources.
- Reviews results of surveys and inspections.
- Studies reports of incidents and adverse findings.
- Recommends courses of action to minimize radiation exposure.

Committee members include:

- IRSO.
- Darnall Army Community Hospital Radiation Safety Officer.
- III Corps Safety Director.
- 1st Cavalry Division (1CD) and 4th Infantry Division (4ID) safety managers, and local radiation safety officers (LRSOs)
- Director of Logistics (DOL), Department of Defense Radiation Testing and Tracking System (DODRATTS) Coordinator.
- 62d Engineer Battalion, 13th COSCOM.
- Teams 9 and 10, 95th Maintenance Battalion.
- Installation Test, Measurement, and Diagnostic Equipment (TMDE) Support Office.
- Maintenance units:
 - 13th COSCOM.
 - 190th, 263d, 597th, 602d Maintenance Companies.

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**Installation
Radiation
Control
Committee
(IRCC)
(continued)**

- 1CD Division Support Command (DISCOM).
 - 15th, 115th, 215th Forward Support Battalions (FSBs).
 - 615th Aviation Support Battalion (ASB).
 - 27th Main Support Battalion (MSB).
- 4ID DISCOM.
 - 4th and 204th FSBs.
 - 404th ASB.
 - 704th MSB

2d

RESPONSIBILITIES

3

ACofS, G1

The III Corps and Fort Hood ACofS, G1

- Manages and monitors the Installation Radiation Protection Program (IRPP).
- Designates (in writing) a primary and alternate IRSO, and submits the IRSO qualifications to the FORSCOM Radiation Control Officer (RCO), for approval.

3a

IRSO

The IRSO will

- Administer the Radiation Protection Program at Fort Hood and within the installation support area.
- Review and approve the qualifications of all subordinate LRSOs.
- Submit as required, a Radiation Incident Report (RCS DD-R&E (AR) 1168), to the FORSCOM RCO, Major Command (MACOM) Commodity Manager, or Army NRC license holder on:
 - Theft, loss of control, destruction, or leakage of radioactive sources.
 - Damage of individually controlled radioactive items.
 - Suspected radiological over-exposures according to AR 11-9, and NRC license requirements.
- Review, as required, equipment, materials, facilities, operations, and procedures involving radioactivity.
- Conduct annual comprehensive audits, surveys, or evaluations.
- Implement safety standards of protection against ionizing and nonionizing radiation.

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**IRSO
(continued)**

- Establish a photodosimetry service for both occasionally and occupationally exposed individuals within the Installation Radiation Safety Office.
- Review and evaluate dosimetry programs at Fort Hood (excluding Headquarters MEDDAC) quarterly.
- Renew and ensure compliance with DA Radiation Authorizations (DARA).
- Ensure that storage and shipment procedures comply with applicable regulations and directives.
- Operate the Radiation Waste Holding Facility at West Fort Hood, and ensure proper disposal of radioactive waste and contaminated radioactive items for both Fort Hood and the support area.
- Maintain an inventory of radioactive items on the installation as furnished by major subordinate commands, and provide a current inventory, to include description, attributes, and location of radioactive items to the fire department.
- Respond immediately to reports of possible contamination or suspected personnel over exposure.
- Accept radioactive items from the Defense Reutilization and Marketing Office (DRMO) for disposal and act as a temporary holding area for MEDDAC radioactive waste selectively.
- Survey Fort Hood museums for radiation sources.
- Conduct quarterly wipe tests and surveys of fire control shops and radioactive material storage areas
- Conduct annual radiation safety refresher training as required

3b

**Commander,
MEDDAC**

Commander, MEDDAC, will

- Provide medical surveillance and evaluations for the installation according to paragraph 6, AR 40-14, Control and Recording Procedures for Exposure to Ionizing Radiation and Radioactive Materials.
- Perform bioassays as needed.

3c

**III Corps
Chemical**

III Corps Chemical will ensure that the wipe-test program in support of the Chemical Agent Monitor (CAM) and Chemical Alarm is conducted according to Appendix H.

3d

DPW and Contracting Command

The Director, Public Works (DPW) and Contracting Command

- Notify the IRSO of any radiation sources that will be used by Army and non-Army agencies (including civilian contractors) while on Fort Hood.
 - Notification is required for both permit and daily use purposes.
- Identify the necessary use of radiation sources during the initial contracting phase to allow sufficient time to process the DA Radiation Permit (a contractor's NRC license alone is not sufficient documentation).
- Ensure fire department personnel are familiar with radiation safety fire fighting procedures (Appendix F), and know locations of individually controlled radioactive materials (see paragraph 3b above).
- Ensure the fire department is aware that radioactive material is stored in all unit NBC rooms and fire control armament shops.

Agencies or contractors operating on Fort Hood, who could have potential radiation sources, must notify the IRSO (287-3329/3725).

Notification is necessary to ensure compliance with NRC license requirements, and initiate processing, if necessary, of a DA Radiation Permit required by AR 11-9.

- Provide necessary equipment and personnel to respond to depleted uranium radiation accident or incident emergency response according to TB 9-1300-278 (Guidelines for Safe Response to Handling, Storage, and Transportation Accidents Involving Army Tank Munitions or Armor Which Contain Depleted Uranium) (Appendix E).

3e

Director, Logistics (DOL)

The DOL will

- Inform the IRSO of receipt and shipment of containers that display radioactive warning labels or symbols that are physically damaged when received.
- Notify the IRSO to monitor packages and perform wipe-tests as required.
- Ensure proper processing of shipping documents according to Title 49 CFR for all radioactive shipments from Fort Hood.
- Employees packaging and processing radioactive materials for shipment will notify the IRSO for package monitoring and placement of labels on documents and packages prior to shipment.
- Employees preparing packages for shipment must be properly trained in hazardous materials packaging and shipping procedures.
- Inform units and activities shipping packages that contain radioactive materials off-post of proper shipping and packaging requirements (for example; a strong tight container such as a fiberboard box, with taped seams and inner packaging material to prevent item from movement or breakage inside the box).

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**DOL
(continued)**

- Properly post the temporary shipping, receiving and secure storage areas containing radioactive materials with radiation caution signs (quarterly surveys will be conducted by the IRSO of these areas), and ensure personnel working in these areas are enrolled in a dosimetry program.
- Provide a point of contact for implementation of the DODRATTS (Serialization Tracking) at Fort Hood for the Chemical Agent Alarm (Appendix F) and CAM (Appendix G), according to AR 710-3, Asset Transaction Reporting System.
- Perform required wipe tests and maintenance on items belonging to National Guard and United States Army Reserves (DOL Maintenance Division).

3f

**Defense
Reutilization
and Marketing
Office
(DRMO)**

The DRMO will

- Screen items relating to Army Master Data File (AMDF) for radioactive components.
- Refer units submitting radioactive items for disposal to the IRSO for item processing.
- Host a walk-through of the DRMO storage yard by the IRSO, upon request.

Note: Radioactive items are not eligible for turn-in or resale. Notify the IRSO for removal of radioactive components when required.

3g

Commanders

Commanders must

- Maintain an inventory of equipment containing radioactive materials.
 - Conduct annual physical inventories and provide III Corps Safety Office a copy of the complete inventory by MSC.
- Declare military equipment containing radioactive material to be transported off post for training purposes, using the written inventory guidance in Appendix B.
- Ensure military personnel, who accompany shipments of military equipment containing radioactive material to off-post locations for training, are properly briefed according to Appendix B.
- Accomplish turn-in of radioactive items according to paragraph 4b.
- Submit the ACADA (M22), CAMs, and Chemical Alarms (M43A1) for wipe-tests according to Appendix H and ensure these items are entered into the unit's ULLS-G system to manage the next wipe-test due date.
- Ensure items are submitted to DSU on or before the next wipe-test due date and that proper serialization tracking transaction documents are prepared according to AR 710-3 (DOL, Bldg. 89010, Bay 4, Room 518, 287-2513).

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**Commanders
(continued)**

- Control and secure equipment containing radioactive material.
- Report lost, damaged, or stolen equipment items that contain radioactive material to the IRSO immediately upon discovery (287-3329/3725).
 - Provide a written report containing information listed in Appendix L.
- Ensure that radiation safety SOPs are written and approved by the IRSO for units
 - That store and maintain the MC-1 Soil Moisture Density Tester.
 - That perform wipe-tests and maintenance on the M43A1/CAM.
 - Armament and fire control shops that process, store, and perform maintenance on tritium (H3) fire control equipment.

3h

**Individually
Controlled
Radioactive
Items (IRCI) or
X-Ray Systems**

Units or activities that have ICRI (Table 1) or industrial x-ray systems (404th and 615th ASB-AVIM) .

- Appoint a LRSO and an alternate (in writing), qualified according to AR 11-9, and regulations pertaining to controlled items.
- Establish a dosimetry service and appoint a dosimetry records custodian in writing to maintain records on persons occasionally and occupationally exposed to ionizing radiation.
- Publish SOPs for operations involving radiation sources.
 - Develop an inspection checklist for internal monitoring and control.
 - Provide a copy of the SOP to the IRSO for approval.
- Conduct wipe and leak tests of controlled sources as required.
 - Maintain results on file.
- Notify the IRSO immediately of any radiation incident or accident.

Note: The IRSO must approve the storage area for film badges in writing. Address queries regarding dosimetry to Chief, US Army TMDE Activity, ATTN: AMSMI-SR-DD, Haley Road, Bldg. 5417, Redstone Arsenal, AL 35898-5400.

3i

**Local
Radiation
Safety Officer
(LRSO)**

The LRSO will

- Ensure that ICRI items are properly used and stored according to this regulation.
 - Confirm that tritiated fire control devices are properly used and stored according to Appendix D (tritiated devices are not ICRI items).

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**LRSO
(continued)**

- Notify the IRSO at least 5 working days prior to movement of any ICRI items.
- Ensure that the following records are maintained for 5 years on each individually controlled radioactive item (establish files and recordkeeping according to AR 25-400-2, The Modern Army Recordkeeping System [MARKS])
 - Reports of survey, tests, inspections, equipment movements, studies and investigations.
 - Inventory and leak or wipe-test reports and results.
- Submit a copy of training certificates and appointment orders for LRSOs and alternates to the IRSO.
- Review the automated data record (ADR) for each individual enrolled in the photodosimetry program quarterly according to AR 11-9.
- Inform the IRSO of loss or damage of ICRI items.
- Provide annual training to personnel occupationally or occasionally exposed to a radioactive source (see Appendix C).

3j

**DOL Optics
Repair Shop
and Unit Fire
Control Shops**

DOL Optics Repair Shop and unit fire control and armament shops will:

- Maintain and file annual audits and surveys by the IRSO or higher headquarters.
- Maintain and file copies of quarterly wipe-test results for tritiated device repair shop and storage areas.
 - Ensure only authorized and trained personnel work in the fire control repair shop restricted area.
 - Provide a written SOP of fire control shop operations that includes purging limitations and required actions to take in the event of an emergency (Appendix D).
 - Comply with emergency actions at Appendix L upon suspected incident and notify the IRSO immediately.

3k

PROCEDURES

4

**Dosimetry
Records**

Dosimetry custodians and managers maintain exposure records and implement guidance on the dosimetry program policy according to this regulation, AR 11-9 and AR 40-5.

- Monitor personnel assigned or attached to Fort Hood who are routinely or occasionally exposed to sources of ionizing radiation as a condition of their employment, for exposure.
 - Note: Personnel are not required to wear film badges when performing wipe-tests on CAMs/ M43A1s at DSUs or when performing maintenance on fire control devices in armament and fire control shops.

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**Dosimetry
Records
(continued)**

- Maintain a DD Form 1952, Dosimeter Application and Record of Occupational Radiation Exposure, on each individual occasionally or occupationally exposed to ionizing radiation.
- The dosimetry custodian will review quarterly dosimetry reports and annotate (initial and date) when the report was reviewed.
 - Report any exposure to the IRSO (287-3329) for evaluation and investigation and recommendation of further action.

4a

**Radioactive
Material and
Equipment
(ICP)**

Dispose of unserviceable or unrepairable radioactive components as radioactive waste (radwaste) unless the item must be returned to a depot.

Disposition instructions from the equipment item manager or the inventory control point will provide instructions to submit items to the local IRSO for proper disposal as radwaste.

Units may seek help in identifying radioactive items from the IRSO, or from TB 43-0116, Identification of Radioactive Items in the Army.

- Special Control Item Code (SCIC) 8 (found on the AMDF) are radioactive items.
- Items suspected to be radioactive, but without a NSN (such as smoke detectors) may be identified by contacting the IRSO.
 - The IRSO will go to the unit to identify the item(s).
- Units will initiate normal turn-in documents, and process them through proper supply channels to receive credit for turn in.
 - The IRSO will not normally receive the item from the unit unless it is determined that the item is contaminated with radiation and poses a health hazard due to accountability concerns.
- DRMO will not accept radioactive items for turn-in.
 - Units will be referred to the IRSO, or return items to the DOL, Bldg. 89010, Bay 2, Room 317.
 - Units must have a turn in appointment, 287-2513.
 - See Appendix I for turn-in instructions for CAMs (M43A1s).
 - If these items are damaged, place in double-wrapped plastic bags, seal with tape, mark with type radioactive isotope(s), and quantity.
 - Place each bag inside another plastic bag, and seal with tape prior to turn-in.

4b

**Army
Radiation
Permits for
Contractors**

Activities (for example, DPW, DOC, or Fort Worth District Corps of Engineers) responsible for contractors who plan to use radioactive sources on the installation, must notify the IRSO.

- The contractor must prepare and submit a DA Form 3337, Application for Department of the Army Radiation Authorization or Permit, to the IRSO at least 30 calendar days prior to the date the source is scheduled for use on the installation.
- The request for permit will be forwarded to CDR, III Corps and Fort Hood, ATTN: ACofS, G1 Safety for approval.
- The Army radiation permit application will specify start and stop dates for the Army radiation permit and describe the purpose for the Army radiation permit.
- The installation commander will approve the application only if the applicant provides evidence to show that one of the following is true:
 - The applicant has a valid NRC license or Department of Energy (DOE) radiological work permit that allows the applicant to use the source as specified in the Army radiation permit application.
 - The applicant has a valid agreement state license that allows the applicant to use radioactive material as specified in the Army radiation permit application, and has *filed* NRC Form 241 (Report of Proposed Activities in Non-Agreement States) with the NRC according to 10 CFR, Part 150, Section 150.20.
 - For NARM and machine-produced ionizing radiation sources, the applicant has an appropriate state authorization that allows the applicant to use the source specified in the Army radiation permit application or has in place a radiation safety program that complies with Army regulations.
- Army radiation permits require that applicants remove permitted sources from Army property by the end of the permitted time.
- Disposal of radioactive material by non-Army property is prohibited.
- The installation commander may authorize radioactive releases into the atmosphere or to the sanitary sewerage system that comply with applicable federal, DOD, and DA regulations.
- The installation commander gives appropriate consideration to state and local restrictions on such releases.

**Appendix A
References**

**Section I. Required
References**

AR 5-9

Intracervice Support Installation
Area Coordination

AR 11-9

Ionizing Radiation Protection
(Licensing, Control,
Transportation, Disposal, and
Radiation Safety)

AR 385-40

Accident Reporting and Records

AR 710-3

Asset Transaction Reporting
System

DA Pam 40-18

Control and Recording
Procedures for Exposure to
Ionizing Radiation and
Radioactive Materials

FORSCOM Reg 350-50-1

Training at the National
Training Center.

FORSCOM Reg 385-1

Forces Command Safety
Program

TB Med 521

Management and Control of
Diagnostic X-Ray, Therapeutic
X-Ray, and Gamma Beam
Equipment

TB Med 524

Occupational and
Environmental Health, Control
Of Hazards to Health From
Laser Radiation

TB Med 525

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

TB 43-0116

Identification of Radioactive
Items in the Army.

TB 43-0197

Instruction for Safe Handling,
Maintenance, Storage, and
Disposal of Radioactive Items
Managed by US Army Armament
Materiel Readiness Command.

TB 9-1300-278

Guidlines for Safe Response to
Handling, Storage, and
Transportation Accidents
Involving Army Tank Munitions
or Armor Which Contain
Depleted Uranium.

TM 3-6665-312-12&P

Operator's and Organizational
Maintenance Manual Including
Repair Parts and Special Tools
List for M8A1 Automatic
Chemical Agent Alarm (NSN
6665-01-105-5623) and Auxiliary
Equipment M10 Power Supply
(6665-00-859-2225) M10A1
Power Supply (6665-00-093-
2739) M228 High Profile
Mounting Kit (6665-00-859-
2212) and M1A2 Low Profile
Mounting Kit (6665-00-110-
9492) to 11H2-17-1)
TM 3-6665-312-30&P, Direct
Support Maintenance Manual
Including Repair Parts and
Special Tools List, for M8A1
Automatic Chemical Agent
Alarm (NSN 6665-01-105-5623)
Consisting of M43A1 Chemical
Agent Automatic Alarm Detector
Unit (6665-01-081-8140) M42
Chemical Alarm Unit (6665-00-
859-2215) and Auxiliary
Equipment M10A1 Power Supply
(6665-01-093-2739) M10 Power
Supply (6665-00-859-2225)
(To 11 H2-17-2)

TM 750-116

General Procedures for Purging
and Charging of Fire Control
Instruments.

FM 3-5

NBC Decontamination.

10 CFR, Title 10

Rules and Regulations of the United
States Nuclear Regulatory
Commission.

29 CFR, Title 29

Rules and Regulations of the
Occupational Safety and Health
Administration.

40 CFR

Rules and Regulations of the
Environmental Protection Agency.

49 CFR

Rules and Regulation of the
Department of Transportation.

**NRC Licenses (NOTE:
Maintained by the IRSO, III Corps
Safety Office, Bldg 1001, and
available for review)**

STB 1433

Magnesium Thorium

SUC 1380

Depleted Uranium

21-01222-05,

MC1, Soil Moisture Density Tester

12-00722-07

Law Rocket Sights

12-0722-06

Tritium, Self Luminous Sources
12-00722-13, Chemical Agent
Detector (M43A1) Chemical Agent
Monitor (CAM)

29-01022-14

CECOM License

Section II.

Related References.

This section not used.

**Section III. Referenced
Forms.**

DD Form 1952

Dosimeter Application Record
of Occupational Radiation
Exposure

DA Form 3337

Application for Department of
the Army Radiation
Authorization or Permit

FORSCOM Form 1038-R

Military Movement of
Radioactive Material

**Appendix B
Standards of Radiation Protection**

Purpose This appendix prescribes procedures for control and protection from ionizing radiation and non-ionizing radioactive sources and materials.

Every effort will be made to maintain the radiation dose equivalent as far below the radiation protection standards as possible, and ALARA.

B-1

General Commanders and activity managers are responsible for minimizing radiation exposure and controlling radioactive material, including

- The orientation and indoctrination of personnel subject to radiation hazards.
- Implementing applicable directives and SOPs.
- Provisions for dosimetry service, and medical examination, as required.

B-2

Background Some military equipment contains radioactive material.

- In most instances, there is only a small amount of radioactive material involved.
- Most of the material is in a container called a "source."

These radioactive materials do not present a hazard to personnel working close to them unless a radioactive source is tampered with, or in some way damaged.

To preclude a potentially hazardous situation, it is important that radioactive sources be properly handled, controlled, and secured.

B-3

Types of Radioactive Sources Practically all radioactive sources found in military equipment are in sealed sources (for example, chemical agent detectors, deicing systems, radiation check sources.

- Protective armor and projectiles containing Depleted Uranium (DU), and instrument dials painted with luminous paints containing radium, tritium, or promethium are exceptions.

There are three types of sealed sources:

- Various instruments, such as chemical detectors, old radium watches and compasses, anti-reflective coating on optics, smoke detectors, and munitions or armor use alpha sources.
- The most common alpha sources are
 - Americium 241 (Am-241).
 - Various isotopes of Plutonium (e.g., Pu-238 and Pu-239).
 - Radium-226 (Ra-226).
 - Thorium 232 (Th-232).
 - Depleted Uranium.

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Types of Radioactive Sources (continued)

- Although an alpha source may have a weak gamma associated with it, this source is considered a negligible external risk since alpha particles can be completely stopped or absorbed by a sheet of paper, or one or two inches of air.
 - The primary hazard from alpha sources is the internal radiation exposure that occurs if the radioactive material is ingested, inhaled, or absorbed through a skin abrasion.
 - An exception to this general rule is Ra-226, which is an alpha emitter but also has a strong gamma radiation associated with it.
- Thickness gauges, nuclear batteries, static eliminators, and luminous dials devices use beta sources.
 - The most common beta sources are
 - Strontium-90 (Sr-90).
 - Promethium-147 (Pm-147).
 - Tritium (H3).
 - Nickel-63 (Ni-63).
 - Beta radiation is moderately penetrating, and is rarely detectable outside the casing of a sealed source.
 - It presents a risk of local skin exposure, and is a significant internal hazard if inhaled or ingested.
 - A thin shield can shield beta particles.
- Radiological test and measurement equipment use gamma sources.
 - The most common gamma sources are
 - Cobalt-60 (Co-60).
 - Cesium-137 (Cs-137)
 - Radium- 226 (Ra-226).
 - Gamma radiation is highly penetrating, and therefore requires substantial shielding to prevent external exposure.
 - The amount of shielding required depends on the source strength, and the energy of the gamma rays produced as the atoms decay.
 - High-density materials such as steel or lead can shield gamma rays.

B-4

Hazards of Radioactive Materials

External radiation exposure is the radiation dose received from radioactive material that is external to the body of radioactive material).

The amount, or size, of an external radiation dose that can result from a radioactive source is dependent on several factors.

- Three types of radioactive sources are

(continued on next page)

**Hazards of
Radioactive
Materials
(continued)**

- Alpha sources, which emit alpha particles.
- Beta sources, which emit beta particles.
- Gamma sources, which emit gamma radiation.

Gamma sources are the primary contributors to external dosage because of the limited penetrating ability of alpha and beta particles.

- Source strength.
 - The source strength, or activity, is normally given in terms of curies (Ci).
 - This represents the number of decays or disintegration per minute (dpm) that occur within the radioactive source.
 - Large sources (one to thousands of Ci) are generally used in research, medicine, and industry.
 - Most radioactive sources found in military components are small (microcuries [uCi] to several millicuries [mCi]).

Internal radiation.

- Internal radiation exposure may occur as a result of inhalation, ingestion, or absorption through the skin or an open wound.
 - Factors that influence the amount of internal dose a person will receive from a radioactive source include:
 - Physical form.
 - Unless it is damaged or otherwise leaking, a sealed radioactive source presents no internal radiation exposure because the radioactive material itself is physically “sealed” in a container and cannot get into the body.
 - Unsealed sources, particularly those in the form of a gas, liquid, or powder, present a greater hazard because of the potential of contamination, inhalation, and ingestion.

Half-life.

- The radioactive half-life is the amount of time required for a radioactive source to decay to half its initial source strength or activity.
- The biological half-life of a material is the time it takes for the body to eliminate one half of the material through the normal biological processes.
 - These two combine to determine the effective time required for radioactive material in the body to reduce to half its initial amount.
 - The shorter this time, the smaller the internal dose.

Type of radiation.

- Alpha radiation causes more internal damage than beta radiation, which, in turn, is more damaging than gamma radiation.
- Source strength.
- The larger the amount of a given radioactive material in the body, the larger the internal dose.

B-5

**Protective
Actions**

There are three concepts that are important in reducing or eliminating the exposure or dose received from radiation emitted by radioactive materials.

- Time.
 - Minimize exposure to the radioactive source.
 - The shorter the exposure, the smaller the radiation dose received.
- Distance.
 - Maximize the distance between you and the radioactive source.
 - The greater the distance from a radioactive source, the smaller the radiation dose rate.
 - In fact, for every doubling of the distance from the source, the radiation dose rate reduces by a factor of four.
- Shielding.
 - Place shielding material between the body and the source to absorb the radiation emitted by the source.
 - Check the radiation level after using a shield.
- Applications of these concepts.
 - If you work with, or find a radioactive source:
 - Minimize exposure to the radioactive source.
 - Maximize the distance between the body and the source.
 - Go near the source only when absolutely necessary.
 - Prevent others from going near the source by posting warning signs.
 - Contact the IRSO for more information and further guidance, as necessary.

B-6

**Basic
Radiation
Standards**

Basic radiation standards adopted for the control of occupational exposure to ionizing radiation are:

- Accumulated dose equivalent to the whole body will not exceed 1.25 Roentgen Equivalent Man (REM) in any one calendar quarter, or 5 REM in any one calendar year.
- Accumulated dose equivalent of radiation to the lens of the eye will not exceed 3.75 REM in any one calendar quarter, or 15 REM in any one calendar year.
- Accumulated dose equivalent of radiation to the hands, forearms, wrist, feet, ankles, lower legs, skin, or any other organ, will not exceed 12.50 REM in any one calendar quarter, or 50 REM in any one calendar year.
 - Individuals under the age of 18 will be limited to 10 percent of the values provided above.
- Females known to be pregnant will not be exposed to an amount of radiation that would result in a dose equivalent to the fetus in excess of 0.5 REM during the entire gestation period.
 - Pregnant females must declare their pregnancy in writing, including the approximate date of conception, according to 10CFR20.
 - The IRSO must keep the declaration on file.

B-7

Administrative Dose When an individual has lost, failed to return, damaged beyond usefulness, or otherwise rendered their dosimetry device unreadable, the individual will be assigned an administrative dose for the period in question.

- Annotate actions taken in the remarks section of the ADR.
- Such doses must be reported to the dosimetry center at Redstone Arsenal, Alabama.
- Determine the dose in one of the following ways:
 - Calculate the individual exposure based on occupational information and exposure levels.
 - Assign 0.416 REM for each month during the period in question.
 - Assign dose from supplemental monitoring devices.
 - Average the exposure over 12 months.

B-8

Controlled Area A controlled area is an area in which the occupational exposure of personnel to radiation is under the supervision of an assigned LRSO or an area that is solely used for maintenance on equipment containing radioactive materials.

The IRSO may also designate a controlled area.

B-9

Postings Units and activities will post the following documents and signs in controlled areas:

- "Caution-Radioactive Material" sign (fabricated), or other appropriate sign.
- Copy of title 10 CFR, Parts 19-21 and section 206 of the Energy Reorganization Act.
- Copy of NRC license and all incorporated documents (when applicable).
- Copy of SOP.
- NRC Form 3 (Figure B-1).
- Any reports of violations.

Note: The IRSO maintains and files NRC Licenses.

B-10

Restricted Area A restricted area is any area designated by the IRSO with limited access, and precautionary measures are taken for the purpose of protecting individuals from exposure to ionizing radiation or radioactive materials.

B-11

Radioactive Material Areas Radioactive material areas are those areas where radioactive materials are stored because of their radioactive component (for example, CAMs, M43A1s).

Each area and principal container in which radioactive material is stored or used will be conspicuously posted with a sign or label bearing the radiation symbol and the words "Caution Radioactive Material."

B-12

Survey Requirements Procedures and Standards

Radiation protection program surveys of units and activities are conducted as required (quarterly or annually) by the IRSO or LRSO, according to AR 11-9, and appropriate NRC Licenses.

- Program surveys ensure
 - Sealed sources are not leaking.
 - Radiation levels are within acceptable limits.
 - Safety and health requirements are properly followed.
 - Administrative recordkeeping is followed.
- Document each survey and forward written results to commanders and managers.
- Monitoring incoming and outgoing shipments containing radioactive materials includes:
 - Physical monitoring with appropriate radiation detecting equipment.
 - Wipe-test sampling of selected shipments.
 - Shipment certification.
 - Each shipment will be certified, and the package marked according to the DOT Title 49 CFR.
 - Label and annotate shipping documents appropriately.
 - A radioactive material movements form will accompany each shipping document or package, and vehicle operator or shipper will have a DD Form 836.
- Radiation contamination guidelines.
- Wipe-test analysis of transportation shipments are according to Title 49 CFR (220 disintegrations (dpm)/100 cm² for alpha, and 2200 dpm/100 cm² for beta and gamma radiation).
- Wipe-test analysis, or radiac meter readings of contaminated clothing, skin, uncontrolled areas, controlled areas, or material leaving controlled areas are according to AR 11-9, Table 4-3.
 - Allowable limits controlled area is 400 dpm; uncontrolled areas is 100 dpm.
 - Values given in AR 11-9, Table 4-3, are maximum values of permitted contamination and may differ according to the isotope.
 - If wipe-test analysis or meter readings exceed these levels, decontamination and resurvey is necessary (contact the IRSO).

B-13

Emergency Procedures (Accidents/ Incidents)

The objective of emergency procedures is the preservation of life and protection of exposure from radiation hazards.

The following emergency procedures are in order of their importance:

- Lifesaving and protection of personnel from radiation hazard.
- Confinement of the contamination, including recovery of lost sources, if applicable.
- Decontamination cleanup.

(continued on next page)

Emergency Procedures (Accidents/ Incidents) (continued)

Disposal of radwaste.

Emergency procedures are:

- Spill of radioactive materials.
- Explosion.
- Overexposure.
- Loss of radioactive material.
- Damage to equipment containing radioactive material.
- Fire.
- Injury to personnel.
- Vehicular accident involving radioactive material.

Most common radiation accidents or incidents include:

- Damaged, lost, stolen, or contaminated Chemical Alarm or CAM.
- Non-illuminating tritium fire control devices.
- Broken glass compass covers, watches, radiac meters, or infrared optics equipment containing radioactive materials.

When any of the above incidents occur, contact the IRSO immediately at 287-3329/3725.

B-14

Supervisor Responsibility

Supervisors

- Post appropriate warning signs and notices.
- Ensure that all personnel who use radioactive commodities or radiation producing devices are adequately trained with annual and refresher training, receive adequate instruction, and if required, receive medical examinations prior to working in their assigned duties.
- Ensure that personnel exposure levels are kept ALARA.
- Ensure that radioactive commodities are secured against unauthorized use.
- Ensure that a written SOP is available, enforced, and reviewed by all personnel whose work requires protection from radiation hazards.
 - IRSO must approve the SOP.
- Ensures that assigned TLDs are worn and stored properly.
 - The IRSO approves storage areas.

(continued on next page)

**Supervisor
Responsibility
(continued)**

- Ensures that radiation program files are maintained according to MARKS.
- Reports to the IRSO any accident, unusual incident, personal injury, suspected overexposure, and broken or damaged equipment containing radioactive materials.

B-15

**Worker
Responsibilities**

Workers

- Read and follow SOPs, rules, regulations and special instructions.
- Maintain and use safety equipment properly.
- Wear assigned TLDs properly and return them to approved storage area at end of work day.
- Report any accident, unusual incident, personal injury, suspected overexposure or contamination as soon as possible to their supervisor.

B-16

Figure B-1. Nuclear Regulatory Commission Form 3, Notice to Employees



UNITED STATES NUCLEAR REGULATORY COMMISSION
Washington, DC 20555-0001

NOTICE TO EMPLOYEES

STANDARDS FOR PROTECTION AGAINST RADIATION (PART 20); NOTICES, INSTRUCTIONS AND REPORTS TO WORKERS; INSPECTIONS (PART 15); EMPLOYEE PROTECTION

NRC FORM 3
(5-1999)

WHAT IS THE NUCLEAR REGULATORY COMMISSION?
The Nuclear Regulatory Commission is an independent Federal agency responsible for licensing, inspecting, and regulating nuclear power plants and other activities involving radioactive materials.

WHAT DOES THE NRC DO?
The NRC's primary responsibility is to ensure the safe use of nuclear energy and to protect the public health, safety, and environment from the hazards of radioactive materials. The NRC also regulates the production, use, and disposal of nuclear materials.

WHAT RESPONSIBILITIES DOES THE EMPLOYER HAVE?
Any employer who employs workers at a nuclear power plant or other facility must comply with the NRC's radiation protection standards. The employer must also ensure that workers are properly trained and supervised.

WHAT IS THE EMPLOYER'S OBLIGATION TO THE NRC?
The employer must provide the NRC with accurate and complete information regarding the activities of the facility. This includes providing access to records and allowing NRC inspectors to perform their duties.

WHAT IS THE EMPLOYER'S OBLIGATION TO THE EMPLOYEES?
The employer must ensure that workers are provided with the necessary training and resources to perform their jobs safely. This includes providing personal protective equipment and enforcing safety rules.

WHAT IS THE EMPLOYER'S OBLIGATION TO THE PUBLIC?
The employer must ensure that the facility operates in a safe and sound manner. This includes implementing emergency procedures and providing information to the public.

WHAT IS THE EMPLOYER'S OBLIGATION TO THE ENVIRONMENT?
The employer must ensure that the facility does not release radioactive materials into the environment. This includes implementing strict controls on emissions and monitoring the environment.

WHAT IS THE EMPLOYER'S OBLIGATION TO THE COMMUNITY?
The employer must ensure that the facility operates in a safe and sound manner. This includes implementing emergency procedures and providing information to the community.

WHAT IS THE NRC'S POLICY ON EMPLOYEE PROTECTION?
The NRC's policy is to ensure that workers are provided with the necessary training and resources to perform their jobs safely. This includes providing personal protective equipment and enforcing safety rules.

WHAT IS THE NRC'S POLICY ON RADIATION PROTECTION?
The NRC's policy is to ensure that workers are provided with the necessary training and resources to perform their jobs safely. This includes providing personal protective equipment and enforcing safety rules.

WHAT IS THE NRC'S POLICY ON SAFETY CONCERNS?
The NRC's policy is to ensure that workers are provided with the necessary training and resources to perform their jobs safely. This includes providing personal protective equipment and enforcing safety rules.

WHAT IS THE NRC'S POLICY ON RECORDS?
The NRC's policy is to ensure that workers are provided with the necessary training and resources to perform their jobs safely. This includes providing personal protective equipment and enforcing safety rules.

WHAT IS THE NRC'S POLICY ON INSPECTIONS?
The NRC's policy is to ensure that workers are provided with the necessary training and resources to perform their jobs safely. This includes providing personal protective equipment and enforcing safety rules.

WHAT IS THE NRC'S POLICY ON COMPLAINTS?
The NRC's policy is to ensure that workers are provided with the necessary training and resources to perform their jobs safely. This includes providing personal protective equipment and enforcing safety rules.

WHAT IS THE NRC'S POLICY ON REGIONAL OFFICES?
The NRC's policy is to ensure that workers are provided with the necessary training and resources to perform their jobs safely. This includes providing personal protective equipment and enforcing safety rules.

WHAT IS THE NRC'S POLICY ON HOTLINE SERVICES?
The NRC's policy is to ensure that workers are provided with the necessary training and resources to perform their jobs safely. This includes providing personal protective equipment and enforcing safety rules.

WHAT IS THE NRC'S POLICY ON COMPLAINTS?
The NRC's policy is to ensure that workers are provided with the necessary training and resources to perform their jobs safely. This includes providing personal protective equipment and enforcing safety rules.

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The NRC's policy is to ensure that workers are provided with the necessary training and resources to perform their jobs safely. This includes providing personal protective equipment and enforcing safety rules.

UNITED STATES NUCLEAR REGULATORY COMMISSION REGIONAL OFFICE LOCATIONS
A representative of the Nuclear Regulatory Commission can be contacted by employees who wish to register complaints or concerns about radiological working conditions or other matters regarding compliance with Commission rules and regulations at the following addresses and telephone numbers.

| REGION | ADDRESS | TELEPHONE |
|--------|--|----------------|
| I | U.S. Nuclear Regulatory Commission, Region I 275 Innovation Road King of Prussia, PA 19381-1110 | (610) 432-1156 |
| II | U.S. Nuclear Regulatory Commission, Region II Attn: Public Contact 17 Peach Street, S.W. Atlanta, GA 30333-2415 | (404) 577-4219 |
| III | U.S. Nuclear Regulatory Commission, Region III 801 Pennsylvania Mall Lynchburg, VA 24502-0001 | (800) 368-3663 |
| IV | U.S. Nuclear Regulatory Commission, Region IV 810 Peachtree Street, S.W. Atlanta, GA 30308-0001 | (404) 970-9677 |



4 - Contact your local NRC Regional Office for more information. The NRC's regional offices are located at the following addresses:

To report safety concerns or
radiological working conditions
to an NRC employee
in your area, call the
NRC's
SAFETY HOTLINE
1-800-695-7403

To report safety concerns or
radiological working conditions
to an NRC employee
in your area, call the
NRC's
SAFETY HOTLINE
1-800-695-7403

To report safety concerns or
radiological working conditions
to an NRC employee
in your area, call the
NRC's
SAFETY HOTLINE
1-800-695-7403

To report safety concerns or
radiological working conditions
to an NRC employee
in your area, call the
NRC's
SAFETY HOTLINE
1-800-695-7403

Appendix C
Movement of Military Equipment Containing Radioactive Material
to National Training Center (NTC) Fort Irwin, California.

General

The movement of military equipment containing radioactive material to off-post locations may be required for training purposes such as National Training Center (NTC) rotations.

Such equipment, when under the immediate control of military personnel, is exempt from shipping requirements specified in 49 CFR 170 to 189.

This exemption applies to the movement of these materials off-post for conducting training, and a national emergency.

Military personnel must accompany the shipment, be knowledgeable of the radioactive materials involved, and be familiar with the associated hazards and emergency procedures to follow in the event of an incident.

In the event of an incident during movement, the shipment commander or NCOIC will notify the III Corps Operations Center, 254-287-2506/2520, who will notify the III Corps Safety Office.

C-1

Procedures

Follow procedures below according to FORSCOM Regulation 350-50-1 (Training at the National Training Center).

- Use FORSCOM Form 1038-R, Military Movement of Radioactive Material, used to control the movement of military equipment containing radioactive material from Fort Hood to NTC.
- Unit personnel will complete Parts 1 through 7 and 9 prior to movement.
- The person(s) responsible for the equipment carry the forms during movement.
- Provide copies of the form to the IRSO and the Installation Transportation Officer prior to movement.
- NTC rotational units consolidate the forms for the task force and forward copies to Commander, NTC and Fort Irwin, ATTN: AFCJ-CSS (IRSO), Fort Irwin, CA 92310-5000, at least 10 days prior to the first training day.
- Perform and document visual inspections recorded in part 8.
- Inspect each piece of equipment containing radioactive material prior to and after movement.
- Report damage which may indicate that the radioactive source is broken or leaking to the IRSO.
- The IRSO will recommend actions to take for contamination and decontamination procedures.
- Inventory information required in part 9 can be found in equipment TMs or in TB 43-0116.

C-2

Appendix D
Radiation Safety Briefings to Workers

Briefings

Individuals working in or frequenting any portion of an area where radiation, or radioactive materials are used or stored, must be informed of:

- Proper storage, transfer, or use of radioactive materials or radiation devices.
- Health protection problems associated with radiation, or radioactive materials.
- Precautions and procedures to minimize radiation exposure.
- Purpose and functions of protective clothing and equipment.
- Appropriate response to warning devices.
- The individual's right to request and receive radiation exposure reports and records.
- The individual's responsibility to report unsafe and/or illegal conditions which may lead to or cause a violation of NRC regulations, licenses, or individual injury or overexposure.

D-1

Radiation Briefings

Radiation workers will receive instruction in:

- Fundamentals of radiation safety.
- Maximum exposure and contamination levels.
- Safe methods of performing work.
 - The use of protective equipment and the operational steps must be demonstrated.
- Procedures to minimize contamination, and to secure sources of radiation from unauthorized use.
- Emergency procedures to follow in case of a radiation accident or incident.

D-2

Extent of Instruction

The extent of instruction will commensurate with potential radiological health protection problems.

Instruction is at least annually and documented by placing record of training in official files.

D-3

Appendix E
Radiation Safety for Fire Control System Components
(Tritium H3 and Thorium 232 (Th 232))

Radioactive Components

Armor, artillery, and infantry units authorized the M1A1/2 Abrams Tank, M109 series Howitzer, or the M2/M3, as well as fire control and armament (term is interchangeable with Optics Repair) shops at forward support, and general support maintenance companies or battalions, are potentially exposed to radioactive components;

- The gunner's primary sight cover windows and the cover to the thermal receiver unit are coated with a mixture of thorium (radioactive) and fluoride (to avoid glare), found on:
 - The Bradley Fighting Vehicle (M2 BFV).
 - Cavalry Fighting Vehicle (M3 CFV).
 - The Abrams Tank (See Figure E-1).
 - The TADS/PNVIS optics on the front of the AH-64 Apache.
 - Night vision sights, Thermal Receiver Units, etc.
 - Radioluminescent (glow-in-the-dark) lamps.
 - The Muzzle Reference Sensor (MRS) (NSN 1040-01-313-8932) compensates for gun tube bend, and contains radioactive tritium gas (H3)
 - Is mounted on the muzzle of the M1A1 tank gun tube.
 - Is also referred to as a collimator (See Figure D-2).
- The M140 Alignment Device (NSN 4931-01-187-9713) is common to M109A2 Howitzers.
 - Is used while bore-sighting.
 - Contains tritium gas (H3) (see Figure E-2).
- The M1A1 Infinity Collimator (NSN 1240-00-332-1780) is common to M109 Series Howitzers.
 - Simulates an azimuth reference target at infinity for artillery laying and firing.
 - Contains tritium gas (H3) (See Figure E-3).
- The M1 Infinity Collimator (NSN 1240-00-066-6065) is not radioactive.
- The M1A2 Gunner's Quadrant (NSN 1290-00-169-1937)
 - Is commonly used with armor and artillery pieces.
 - Measures elevation and depression angles.
 - Contains tritium gas (H3) (See Figure E-3).
- The M1A1 Gunner's Quadrant (NSN 1290-00-891-9999) is not radioactive.

The above items are just a few of the many military fire control devices that contain H3.

The radiation trifoil marking or symbol identifies each piece of equipment.

E-1

Thorium-Fluoride Coated Optics

The anti-reflective coating on thermal optics contains thorium-fluoride, which is radioactive.

The potential hazard involves ingestion (swallowing or inhaling) of the flaking particles when the device is broken (see Figure E-1).

- When breakage occurs, cordon-off the area and notify the IRSO.

(continued on next page)

**Thorium-
Fluoride
Coated
Optics
(continued)**

- Material must be contained, swept up (wet method), and placed in double-wrapped plastic.
- Personnel involved in clean up should wear dust paper masks and latex rubber gloves.
- The IRSO should monitor clean up, and dispose of broken lens covers as necessary.

E-2

**Radio-
luminescent
Lamp Safety**

Radioluminescent lamps contain a Pyrex glass capsule coated on the inside with phosphorus and filled with tritium gas (H3).

The interaction between the phosphorous and tritium produces light for night-time illumination of the reticle pattern.

The source is well protected, and poses no significant hazard as long as it remains intact.

- Maintenance.
 - Maintenance on the radioluminescent lamp is not authorized.
 - Tampering with or removing these radioactive sources is prohibited.
 - Repair is limited to replacement of external parts, provided the radioactive source is not broken.
 - Do not attempt repair.
 - Exercise care when handling the radioactive cell.
 - Avoid tampering with or dropping the cell.
 - Never leave the part laying around where it could sustain accidental damage.
 - TM 750-116 contains procedures for purging and charging fire control instruments.
- Markings.
 - External radioactive warning lables identify radioactive self-luminous sources
 - Do not deface or remove labels.
 - Replace damaged labels immediately.
 - Contact the IRSO for labels when they are missing on any equipment containing radioactive material.

The radiation emitted by tritium is of such a low energy level that it cannot penetrate the glass capsule, however, if the capsule is broken, the tritium gas will dissipate and any surfaces near the break may become contaminated with H3 oxide residue.

- The body can absorb tritium oxide through
 - Inhalation.
 - Ingestion.
 - The skin, or an open surface wound.

(continued on next page)

Radio-luminescent Lamp Safety (continued)

-
- Preventive measures.
 - Do not eat, drink, or smoke in areas where radioactive materials are used or stored.
 - Local SOPs are required for all maintenance and storage operations involving tritium devices.
 - SOPs must include instructions for
 - Safe handling.
 - Storage.
 - Disposal.
 - Shipping.
 - Monitoring.
 - Emergency procedures involving these radioactive devices.
 - The Commander must sign the SOP.
 - The IRSO must review and approve the SOP.
 - Safety surveillance
 - To keep personal exposure ALARA, the IRSO will:
 - Conduct wipe-tests of fire control maintenance and storage areas, and document surveys.
 - Respond immediately to incidents concerning tritium devices reported by units, and report incidents to higher headquarters, as required.
 - Conduct random audits of MSC fire control or armament shop facilities, and review operational procedures.
 - Coordinate bioassays of workers exposed to tritium with local medical facilities.
 - Confiscate contaminated tritium devices, monitor, and supervise contamination clean-up, and dispose of H3 waste.
 - Storage.
 - Store equipment in the original container until used, or install on a weapon system.
 - Store equipment containing tritium in an unoccupied building that has a minimum of 12 air changes per day.
 - An outside, unoccupied, and well-ventilated (at least 12 air changes per day) shed-type storage area is recommended.
 - Store not more than 200 Ci of tritium in one location
 - Not more than 20 M1A1 Infinity Collimators.
 - Defective radioactive illumination devices may be shipped to depot for repair depending on the disposition instructions from the item manager.
 - Place damaged items in a double-wrapped plastic bag, and place inside the original shipping container.
 - The IRSO will ensure defective items are properly packaged and shipped or disposed of.
 - Training.
-

(continued on next page)

Radio-Luminescent Lamp Safety (continued)

- Personnel required to perform maintenance on tritium devices must receive a one-hour annual safety training class on the hazards of tritium, and emergency procedures to follow in the event of an incident.
 - The IRSO usually conducts training.
- Loss of illumination.
 - Maintenance will only be performed on non-illuminating tritium devices at authorized depots.
 - In most cases, the devices will be turned over to the IRSO for proper disposal.
 - No maintenance will be performed on non-illuminating tritium devices at Fort Hood.
 - Only the IRSO will dispose of non-illumination devices as radwaste.
 - Tritium devices suspected of leaking or discovered to be non-illuminating, should be placed in a double-wrapped plastic bag, and placed in a strong, tight container (for example, a fiber board box with taped seams).
 - Label the carton "caution, broken tritium source-do not open."
 - Notify the IRSO immediately, 287-3329/3725.
 - Wear latex rubber gloves when handling the broken device, and dispose of inside the bag when finished handling.

E-3

Muzzle Reference Sensors

The MRS, or collimator, is a device that uses a radioactive gas (tritium-H3) for night-time illumination.

cell

The tritium gas is inside a sealed housing, embedded in a shock absorbing material within a steel forming the cell assembly.

If intact and illuminating, proceed with authorized TM maintenance procedures.

The source is well protected and poses no significant hazard as long as it illuminates (Figure E-2).

- Once removed from the gun tube by organizational maintenance, look through the collimator's viewing end for a broken or cracked window, or optic cell assembly.
- If intact and illuminating, proceed with authorized organizational maintenance.
- If the MRS is broken or cracked but still illuminates, forward the device to the support battalion fire control or armament shop.
- If found without illumination at any maintenance level, notify the IRSO and follow instructions in paragraph 3 above.
- Removal of the optic beam splitter source/assembly is not authorized.
- ***It is against federal law to attempt to repair or replace the beam splitter source without proper authorization.***
- If skin contact is made with any area suspected to be contaminated with tritium, immediately wash the area with non-abrasive soap and water.
- Dispose of the removed moisture absorbing dessicant as radwaste.

E-4

**M140
Alignment
Device**

The alignment device lamp illuminates a reticle pattern with a radioactive tritium source.

Make the following visual checks:

- All levels of maintenance will look through the device's objective end and check for a broken or cracked reticle and for loss of illumination.
- If the reticle is intact, not cracked, and the device is illuminating, proceed with maintenance actions.
- If cracks are found, or the device is not illuminating, seal the device in a double plastic bag and forward the device to general support maintenance.
- Only general support-level maintenance may purge, charge, or remove the potted cap assembly.
- General support-level maintenance will also perform the visual checks mentioned above.
- If no illumination is observed, only general support-level maintenance will remove the potted cap assembly and check for illumination in a dark room.
- If only a slight glow or haze appears or if illumination is not detected, notify the IRSO.
 - Seal the potted cap assembly in a double-wrapped plastic bag.
- Do not disassemble the potted cap assembly.

E-5**M1A1
Infinity
Collimator**

Although the collimator lamp is battery operated (non-radioactive), the M1A1 collimator lamp illuminates the reticle pattern containing a radioactive source.

- Make the following visual checks:
 - All levels of maintenance will look through the device's objective end, check for a broken or cracked reticle, and loss of illumination.
 - If the reticle is intact, no cracks are found, and the device is illuminating, proceed with maintenance actions.
 - If cracks are found or the device is not illuminating, seal the device in a double-wrapped plastic bag and notify the IRSO.
- Only DOL Maintenance purges the M1A1 Infinity Collimator.
 - Use a regulator; pressure must not exceed 3PSI.
- If illumination is not observed, only DOL Maintenance will remove the collimator scope assembly (NSN 1240-01-124-1358), and check for illumination in a dark room.
 - If only a slight glow or haze appears, or if illumination is not detected, notify the IRSO.
 - Seal the collimator scope assembly in a double-wrapped plastic bag for return to depot.
- Do not disassemble the collimator scope assembly.

E-6

**M1A2
Gunner's
Quadrant**

There are two versions of the gunner's quadrant.

- The M1A1 (non-illuminating).
- The M1A2 (illuminated with radioactive tritium for night vision).
- Return the M1A1 quadrant to depot when determined to be unserviceable.
- All levels of maintenance must perform the checks contained in TM 1240-324-34&P on the M1A2 gunner's quadrant:
 - Check for
 - Cracked, broken, or loose level vial.
 - An elongated bubble (indicating that the level vial is cracked if the crack is not visually detected).
 - Low illumination of radioactive level vial in a darkened room.
 - If cracked, with elongated bubble or with little illumination,
 - Seal the entire device in a double-wrapped plastic bag.
 - Place the item in the original or replacement shipping container, and return to depot for disposal or repair.

These NSNs contain H3: 1290-01-037-7289; 1290-00-150-8891; 1290-01-037-3883; 1290-00-169-1937. See TB 43-0116.

E-7

**Emergency
Procedures**

If the glass capsule (lamp) in any tritium device breaks or is discovered to be broken, take the following action (see also Appendix L):

- Anyone who may have touched or handled a broken capsule should wash arms, face, hands, and other exposed areas of the body, as soon as possible with non-abrasive soap and water.
- Report the incident, regardless of the significance, to the IRSO at 287-3329.
- Restrict access to the room or area of breakage.
- Cordon-off area.
- Post signs designating the area as "Hazardous-Do Not Enter."
- Area must remain restricted until wipe-test results indicate no contamination.
 - Do not return the area to normal until notified to do so by the IRSO; the IRSO may direct individuals to report to Darnall Army Community Hospital for a bioassay.

(continued on next page)

Emergency Procedures (continued)

- Contain potential contamination.
 - Wear latex rubber gloves.
 - Wrap device in double-wrapped plastic bag and seal.
 - Place package in a cardboard box and label "Caution-broken tritium device-do not open."
 - Store broken device in a secure, outdoor, restricted storage area.
 - Dispose of used gloves as radwaste by placing them inside of a bag.
 - Wash hands.

Perform authorized maintenance according to the applicable TMs.

E-8

Figure E-1. Equipment Containing Radioactive Isotopes.

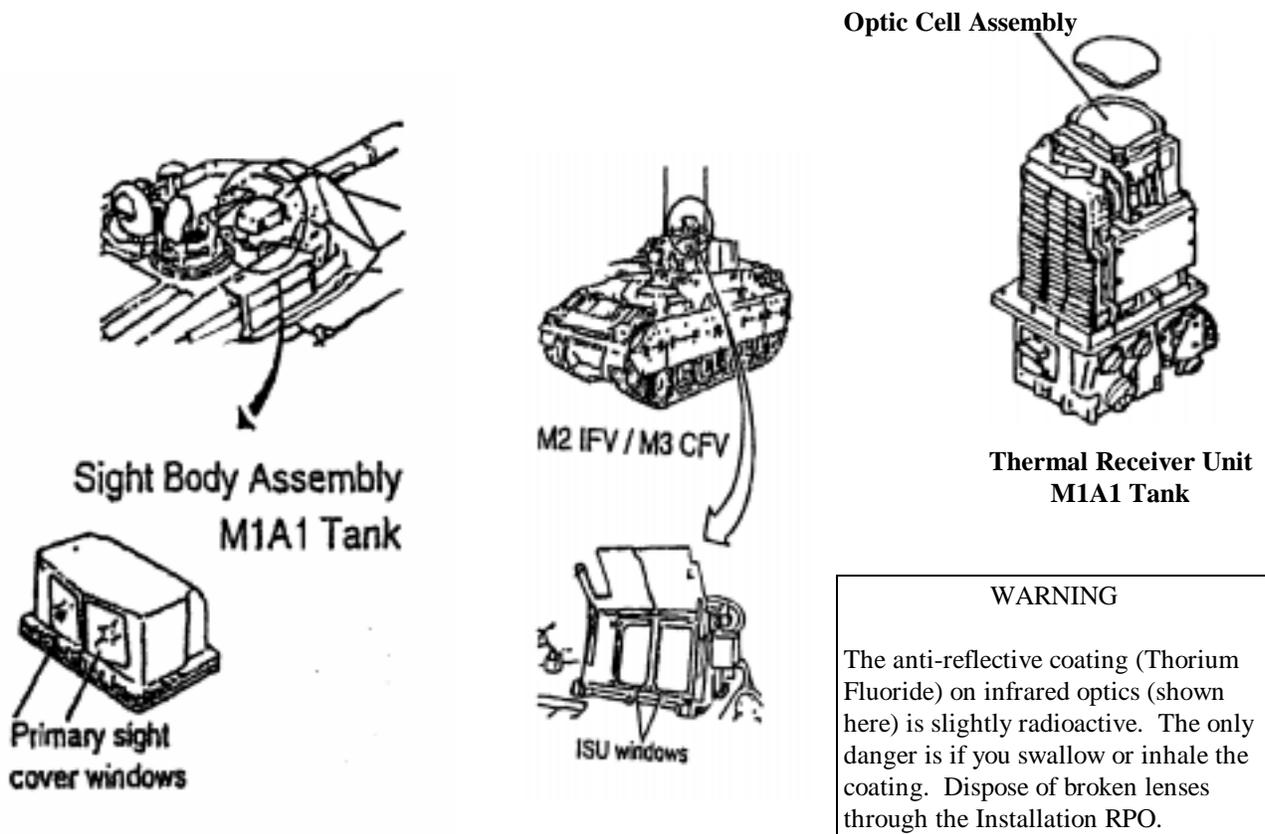
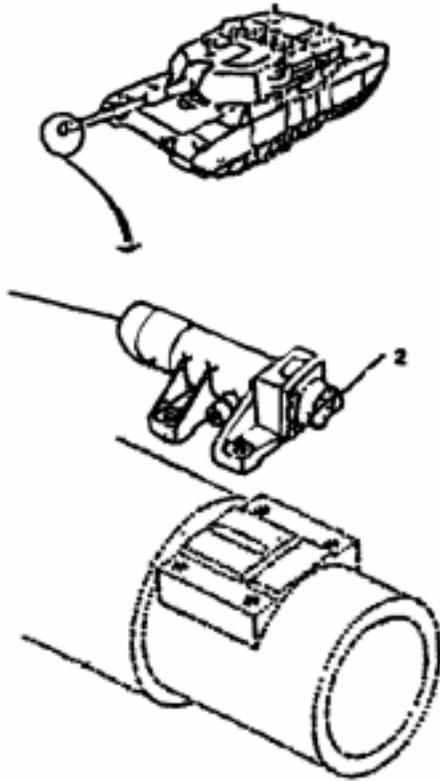


Figure E-1. Equipment Containing Radioactive Isotopes (continued)



Collimator Assembly
M1A1 Tank

WARNING

Handle the collimator (1) with extra care. The tritium cell (2) holds a radioactive gas if the cell is cracked or broken:

Do not touch the cell.
Get out of the area.
Report the damaged cell to the IRPO.
Stay out of the area for 15 minutes.

If radioactive gas from the cracked or broken cell gets onto your skin or clothing immediately notify the Installation RPO.

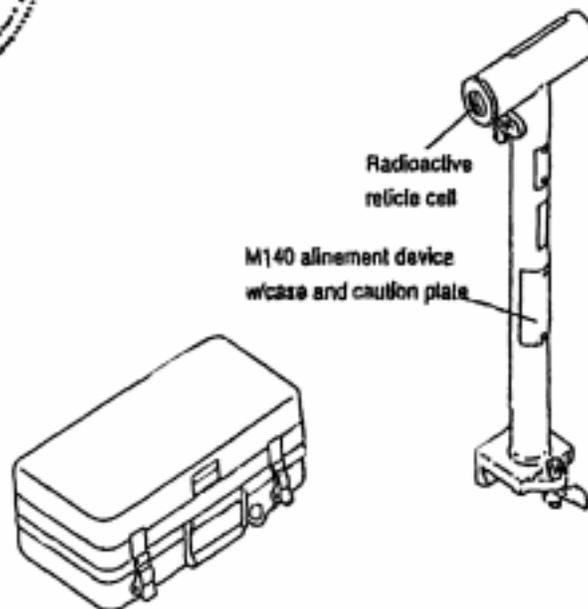
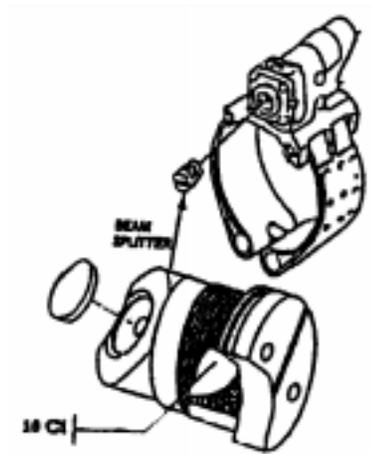
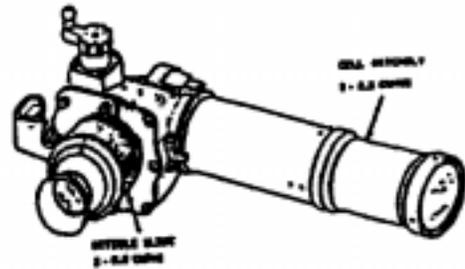


Figure E-1. Equipment Containing Radioactive Isotopes. (continued)

M1 Muzzle Reference

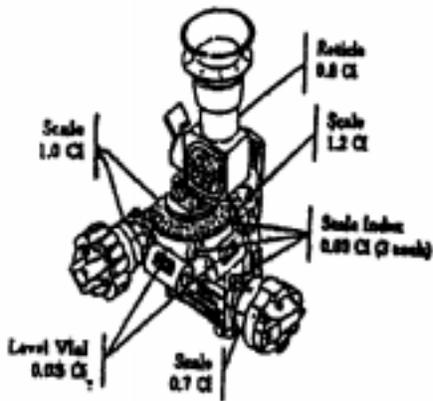


M114A1 Elbow Telescope



Four tritium sources, total activity 5.6 ci

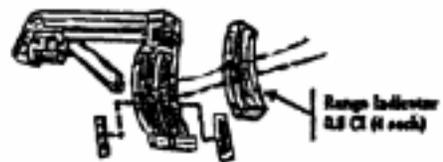
M64A1 Sight Unit w/M9 Elbow



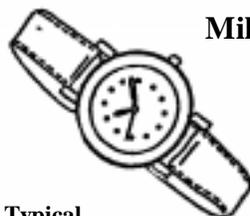
| Source | Activity |
|----------------|----------|
| Reticle | 0.8 Ci |
| Scales (total) | 3.9Ci |
| Scale Indices | .03Ci |
| Level Vial | .05 Ci |

Used to determine rough range estimation for the lightweight mortar

Total activity of 3.



Military Issue of Watches



Typical watch

Maximum activity of .025 Ci

No associated hazard as long as the face crystal remains intact

Appendix F
Depleted Uranium (DU) Armor, Munitions, Emergency Response

DU Armor DU is present in the turrets of all M1A2 and some M1A1 tanks, but poses no external or internal radiation exposure threat unless the outer armor steel turret ruptures.

- The “U” in the serial number indicates the presence of DU (see information plate inside near gunner’s seat).

Radiation readings on external surfaces of components containing DU packages must not exceed 0.5 MRAD per hour.

- Damage to the stainless steel package and exposure of the DU may contaminate surfaces and personnel with DU oxide.

Special facilities or equipment for tanks equipped with DU armor are not required; however, units will develop emergency response and reporting procedures that comply with the NRC license and Army regulations (see paragraph F-2 below).

DU oxide present in equipment damaged or destroyed by DU munitions poses a health hazard.

- Personnel exposed to DU during recovery operations must take adequate safety precautions.

F-1

Accidents Report the following accidents and incidents involving the heavy armor tank immediately to the IRSO at 287-3329:

- Theft or loss of control of DU packages.
- Incidents that damage or expose DU armor to the environment.
 - If DU is exposed, cover the exposed area immediately (use tape or cardboard, etc).

F-2

DU Munitions The DU penetrator is a kinetic energy projectile in armor piercing munitions.

- DU munitions cannot be
 - Buried.
 - Destroyed (detonated or burned).
 - Disassembled.
- Safety standards must be followed when storing, handling and using DU munitions:
 - Do not perform dust, fume, mist, or gas-producing operations on the DU penetrator.
 - The quantity of DU rounds stored within a storage structure will not be a limiting factor.
 - User storage security measures for ammunition are adequate to control the radioactive material.

Accountability for DU munitions is according to DA regulations, and is considered sufficient for radioactive material control and accountability.

(continued on next page)

**DU Munitions
(continued)**

- Post storage areas with sign that reads “CAUTION-RADIOACTIVE MATERIALS.”
- Notices, instructions and standards must be posted in work areas to warn workers of potential radiation hazards (10CFR 19.11).
- The IRSO will provide annual radiation safety training in the hazards of DU to all ammunition handlers and surveillance personnel involved with DU munitions.
- The primary hazard to consider is the explosive danger of the munitions, not the radioactive material.
- An inventory showing NSN/DODIC, quantity, and location must be maintained.

F-3

**DU Emergency
Response**

Initial emergency response and notification (potential incidents or accidents include tank fires, DU storage bunker fire, tank turret damaged or exposed, or DU penetrator exposed due to blunt force or gouging.

- Report incidents or accidents involving DU immediately to the III Corps Operations Center, 287-2520/2054.
 - The Corps Operations Center will notify the IRSO, PMO, EOD, Fire Department, and Public Affairs Officer.
- TB 9-1300-278 (Guidelines for Safe Response to Handling, Storage, and Transportation Accidents Involving Army Tank Munitions or Armor Which Contain Depleted Uranium (DU)) contains specific response procedures to emergencies involving DU munitions.
- Local Fire Department personnel will be familiar with safe procedures when fighting fires involving DU components, contained in TB 9-1300-278 (for example; SCBA, stay upwind from fire).
- The first priority is to assist injured persons.
 - Danger to radiation exposure is minimal compared to the danger of exploding ammunition.
- Cordon off and secure the area.
 - Tank armor (50m), DU storage bunker (2000m).
- Personnel involved in emergency response will stay upwind from the fire.
- The Fire Chief or the designated leader on site will coordinate command and control of the emergency response team actions at the site.
- If ammunition is burned or exploded, treat the residue as radwaste.
 - The IRSO will dispose of the waste properly.
 - Control and contain wastewater runoff and dispose of properly.
 - Coordinate disposition with the IRSO.

(continued on next page)

-
- DU Emergency Response (continued)**
- Personnel involved in emergency response will wear protective outer clothing and appropriate respirator for protection from inhalation of radioactive materials.
 - Chemical suits and protective masks are adequate protection for military personnel.

F-4

Appendix G
M8A1 Automatic Chemical Agent Alarm (ACAA)

General The Chemical Agent Alarm (M8A1) consists of the alarm unit (M42) and the detector unit (M43A1).

- The NRC license is 12-00722-06.

The detector unit houses the radioactive source, Am-241.

The NRC license requires the training, storage, wipe-testing, safety, and emergency procedures outlined in the following paragraphs.

G-1

Training and Operations

TM 3-6665-312-12&P governs the safety, care, and handling of chemical alarms.

- Personnel performing maintenance on the M43A1 and who perform the annual wipe-test, must have at least 8 hours of radiation safety training, which includes hazards of Am-241, biological effects of radiation, radiation detection instrumentation, wipe-testing, serial number tracking and emergency procedures.
- Personnel with a Military Occupational Specialty (MOS) 35F receive this training at the Fort Gordon, Georgia, Army service school.
- The IRSO will present annual radiation safety refresher training.

Direct Support Unit (DSU) maintenance companies conduct wipe-tests and maintenance on the chemical alarm.

- It is preferable that personnel be school-trained; however, personnel assigned to the DSU may receive on-the-job training to conduct wipe-tests, and must still have eight hours of radiation safety training.
- DOL, Maintenance conducts wipe-tests on M43A1s belonging to contractors, 21st Cav Bde and Army Reserve and Guard units.
- A wipe-test on the chemical alarm is an annual requirement.
- Do not perform maintenance until wipe-test results are received from the laboratory in Rock Island, Illinois.

(continued on next page)

Training and Operations (continued)

- DSU maintenance procedures are limited to modular replacement only, and are not authorized to remove or work in air flow path components, except for replacement of the module assemblies.
- Air path tubing replacement is no longer authorized.
- Perform authorized maintenance only.
- FSBs and maintenance companies will maintain files according to MARKS and keep on file current safety of use messages and maintenance advisories.

G-2

Storage and Markings

Secure and store M43A1s in flame resistant metal containers.

- Storage areas must be free from danger of flooding.
- If two or more M43A1s are stored in one container, the container and the immediate entrance into the storage area must be posted with signs stating

"CAUTION-RADIOACTIVE MATERIAL."

- One detector must be stored in a secure area, but marking is not required.
- Original M43A1 containers will be properly marked for shipment (units should retain these containers for shipment, when required).

G-3

Wipe-Testing

Wipe-testing is required annually, prior to maintenance.

Unit commanders and DSUs will comply with wipe-test procedures and guidance contained in Appendix H.

Units must submit CAMs and M43A1s to their DSU on or before the wipe test-due date.

- Commanders ensure that both of these items integrated into the ULLS-G system as maintenance services due in the month of wipe test due date.

G-4

Safety

When the M43A1 is used indoors, a 0.2 micron exit port filter will be used according to TM-6665-312-12&P.

Operators must wear disposable gloves when handling the outlet filter.

- When the filter is no longer usable, dispose of the filter and the gloves in a plastic bag marked "Am-241, Radioactive Trash" and notify the IRSO at 287-3329 for pick up.

Secure storage areas against unauthorized access.

- Storage areas will be away from a danger of flooding, and outside the danger radius of flammables and explosives.

(continued on next page)

**Safety
(continued)**

- TM 3-6665-312-12&P contains notices, instructions, and standards which must be made available to all users of the M43A1 Alarm.

Maintenance personnel for the M43A1 must have a AN/VDR-2, PDR 77, or equivalent, alpha detection equipment, actively calibrated, to perform wipe-tests according to TM 3-6665-312-12&P.

Maintenance areas will be surveyed at the end of each work day that maintenance is performed.

- If readings taken of craft paper covered work areas are not above initial background readings taken before commencing maintenance, dispose of the paper as ordinary trash.
- If readings are twice above background, dispose of the paper as radwaste (to be picked up by the IRSO).
- When in doubt, call the IRSO.

G-5

Reconciliations

Units, DSUs, and DOL Installation DODRATTS Coordinator (287-2513) must work together to ensure proper serial number tracking is performed according to AR 710-3.

- Unit inventory of the M43A1 detector and cell serial number must be reconciled with the Installation DODRATTS Coordinator.

G-6

**Emergency
Procedures**

In the event of an accident or damage (other than fire) to the detector, assume contamination is present until determined otherwise.

Use the following emergency procedures as a guide:

- Remove the injured and isolate the area.
- Notify the IRSO and the unit nuclear, biological, and chemical (NBC) Officer or NCO.
- Identify personnel potentially contaminated, and perform contamination survey with an alpha probe of radiac set of personnel, equipment and area to detect alpha contamination.
- A radiac set with a beta/gamma probe may be used to locate a lost source (cell) or one damaged beyond recognition by fire.
- Decontaminate the area, personnel, and equipment (as required).
- Non-abrasive soap and water is sufficient for potentially contaminated skin.
- Place soil and other equipment suspected of contamination in a double-wrapped plastic bag, and give to the IRSO for evaluation and disposal.
- Place the damaged M43A1 in a double-wrapped plastic bag.
- The IRSO will provide disposition instructions (normally to take to DSU for evaluation; see Appendix J).

In a fire emergency, the concern is airborne contamination downwind.

- Fire fighters fight large fires upwind, if possible.

(continued on next page)

Emergency Procedures (continued)

- Portable air systems should be worn.
- Attempt to extinguish small fires.
- Evacuate the area, and remain upwind of the fire.
- Turn off all ventilation equipment.
- Close all doors and windows (to limit the spread of contamination).
- Perform procedures for accidents or damage previously listed in this paragraph.

It is recommended that the chemical alarm be kept in sight during all training and field exercises to preclude loss or damage by heavy equipment.

TM 3-6665-312-12&P contains further guidance.

G-7

**Appendix H
Chemical Agent Monitor (CAM)**

General

The CAM is common to all units.

NRC License 1200722-06 requires that training, storage, maintenance, and emergency procedures outlined in the following paragraphs be adhered to.

H-1

Training

Information contained in TM 3-6665-327-13&P is sufficient for training qualified operators.

Direct Support Maintenance personnel performing maintenance, or the annual wipe test, must have a minimum of eight hours of radiation safety training, which is generally presented at service school for MOS 35F, and includes instruction in the following:

- Structure of matter, radiation units, absorption of radiation, and shielding.
- Hazards of Ni-63 and its location in the instrument.
- Handling and use of radiation detection instruments.
- Emergency procedures (to include reporting) and decontamination.
- ARs concerning use, storage, transfer and disposal of radioactive items.
- Wipe-test procedures and safety.
- Transactions required for serial number tracking according to AR 710-3.
- Parts 19, 20 and 21 of Title 10 CFR.
- Annual refresher radiation safety training will be conducted by the IRSO.

H-2

Storage

Storage areas will be

- Secure against unauthorized access.
- Away from flood danger.
- Outside the danger radius of flammables and explosives.

Storage area sign requirements are the same as M43A1 requirements stated in paragraph 3, Appendix F.

TM 3-6665-327-13&P contains notices, instructions, and standards which must be made available to all CAM users.

H-3

Maintenance

The user (unit commander) will ensure the CAM is wipe-tested annually.

- The CAM is turned-in to their Direct Support Maintenance team on or before the next wipe-test due date.
- DOL Maintenance Division will wipe test and perform maintenance on CAMs and M43A1s belonging to National Guard or U.S. Army Reserve units.
- CAMs integrate into the unit's ULLS-G System as maintenance services due.
- Unit inventory of the CAM (by monitor and drift tube number) will be reconciled annually with the Installation DODRATTS Coordinator, Supply and Services Division, DOL, 287-2513 (Appendix H).
- Direct Support Maintenance Companies and FSBs will:
 - Perform annual wipe-tests according to TM 3-6665-327-13&P, this regulation, and applicable TMs.
 - Mail wipe-tests to the Rock Island Arsenal, Illinois, laboratory for analysis (see Appendix H, paragraph 4 for mailing address).
- Maintain a record of wipe-test results.
- Monitor each wipe-test sample with a properly calibrated beta radiation detection instrument (that is, PDR-27, PDR 77, or VDR-2 with beta probe).
- Affix a wipe-test label, including the organization, CAM, drift tube serial numbers, date of current wipe-test, and the next wipe-test due date, to the outside of the CAM near the radioactive symbol warning label.

ACALA, Rock Island Arsenal Laboratory, will notify DSUs of wipe-test sample results.

- If the wipe-test fails (indicating contamination), notify the IRSO.

(continued on next page)

**Maintenance
(continued)**

DOL will

- Accept reports of
 - Receipt.
 - Shipment.
 - Unit transfer.
 - Loss.
 - Suspected loss or theft.
 - Wipe-test analysis.
 - Turn-in.

Complete actions necessary according to radiation testing and tracking system requirements contained in AR 710-3.

H-4

**Emergency
Procedures**

Follow the same emergency procedures for the Chemical Agent Detector (M43A1) described in Appendix F.

H-5

**Appendix I
Turn In of Unserviceable CAMs,
M43A1 Detector Unit, NSN 6665-01-081-8140, and
Detector Cell, NSN 6665-01-114-0073**

**M43A1 and
Detector Cell**

The M43A1 Detector Unit, NSN 6665-01-081-8140 and the Detector Cell, NSN 6665-01-114-0073, both components of the M8A1 Chemical Agent Alarm are no longer on the automatic return list.

Report all returns to ACALA as excess according to AR 725-50, Chapter 7.

Each of these items must show documentation of an unserviceable return before a replacement is issued due to the NRC license guidance.

Both items are

- Radioactive as long as the detector cell is intact.
- Accountable Class 2 items.

When a detector is sent to DS or TMDE for maintenance, the owning unit Installation Accountable Property Officer (IACTPO), Material Management Center Officer (MMCO) or Property Book Officer (PBO) (hereafter referred to as the Accountable Officer), reports the following to the Direct Support/TMDE unit after the using unit hand receipts the detector to the Direct Support/TMDE unit:

- The serial number of the detector and detector cell.
- The UIC and DODAAC of the owning activity.

(continued on next page)

**M43A1 and
Detector Cell
(continued)**

- Office symbol, address, and phone number of the owning activity's Accountable Officer.

The Accountable Officer must get a hand receipt copy of the DA Form 2407 from the DS/TMDE that is performing maintenance on the detector, listing all related serial numbers.

If a defective cell is found in the detector, the DS/TMDE unit must:

- Report the defective cell serial number(s) to the owning unit's Accountable Officer.
- Obtain the turn in document number from the Accountable Officer and offer the defective cell as excess to this HQ, according to AR 725-50, Chapter 7.
- The excess card (Document Identifier Code FTE) should be submitted off line to Director, ACALA, ATTN: AMSTA-AC-MMN-C, (DSN 793-5131) and annotated with the following information as exception data:
 - Serial number of the defective cell/detector to be turned in.
 - The Unit Identification Code (UIC) and DODAAC of the owning activity.
 - The FTE should then be phoned in to this HQ, ATTN: AMSTA-AC-MMD-DC for processing (DSN is 793-5278).
- The owning unit Accountable Officer must be informed of the excess.
- After the defective cell/detector has been properly turned in and documented, DS/TMDE may requisition the replacement cell/detector, through the Accountable Officer
- TMDE/DS unit can be used as the destination on the requisition, however, the property book officer will then hand receipt the item to the maintenance unit.
- Phone in the requisition to: AMSTA-AC-MMD-DR, DSN 793-6874/3130, or mail to ACALA, ATTN: AMSTA-AC-MMD with the following exception data:
 - The serial number of the defective cell/detector.
 - The FTE document number of the defective item(s).
- The owning units UIC and DODAAC.
 - Point of contact for the Accountable Officer, office symbol, and DSN number.
- ACALA will match the turn-in information with exception data on the requisition.
 - If there is a match, a new cell will be issued.
 - ACALA will issue disposition instructions on the old cell.

(continued on next page)

**M43A1 and
Detector Cell
(continued)**

- After replacement of defective cell/detector:
 - DS/TMDE will return item(s) to the Accountable Officer, who secures a signature on a hand receipt/DA Form 2407.
 - Accountable Officer will hand receipt item(s) to owning unit.

I-1

**RATTS
Reporting**

The M43A1 Chemical Agent Detector, a component of the M8A1 Chemical Agent Alarm contains a cell module with a radioactive source.

The U.S. Army uses cell modules under NRC License 12-00722-06, issued to III Corps.

- The NRC License requires serial number control of the cell throughout its life cycle.
- Proper documentation of any changes of ownership must be reported to the RATTS according to AR 710-3.
- The Accountable Officer prepares Ship ("S") Transaction cards for each cell or detector module being turned in, and Receipt ("R") transaction cards for replacement items.
 - These transaction cards must be sent to the DODRATTS Reporting Activity at the installation to ensure that movement of the cell modules is reported to the RATTS system.
- It is the Accountable Officer's responsibility to coordinate with the RATTS Installation Reporting Activity to report all transactions involving shipment, receipt, or loss of the radioactive cell according to AR 710-3.
- This regulation describes a 5-day suspense for such notifications.

M43A1 POC: AMSMC-MMC-C, DSN 793-5131
E-MAIL: CSAMPLE@RIA.EMH2.ARMY.MIL

CAM POC: MS KARLA KEUSTERS DSN: 793-6446

Turn in procedures apply to both the CAM and chemical alarm.

I-2

**Fort Hood
Turn-In
Procedures**

When modules for Chemical Agent Monitors and M43 Detectors are coded for turn-in at the supporting DSU, the DSU retrogrades to the 565th GS Co.

- The unit should requisition a serviceable module.
- When the DODRATTS Coordinator verifies that the reported items are shipped, that is, offers the final TCN shipment information the losing DSU can reorder a replacement module.

(continued on next page)

**Fort Hood
Turn-In
Procedures
(continued)**

The 565th GS Co. will pack like items coded for turn-in.

When final packaging is complete, the 565th GS Co. forwards the shipping Transportation Control number (TCN) to the DODRATTS Coordinator.

- If multiple items are packed into a multi-pack shipment, use the lead TCN (final TCN) for recording with the DODRATTS Coordinator.

The DODRATTS Coordinator requires several items to complete the audit trail:

- The shipping TCN.
- Document number.
- Quantity.
- Both the cell or module and detector SN.
- The shipping activity.

The address and telephone number for the Fort Hood DODRATTS Coordinator is:

DODRATTS Coordinator,
DOL, Supply and Services Division,
ATTN: AFZF-DL-S
Bldg. 89010, Bay 4, Room 518
(254)287-2513 or DSN 737-2513

Appendix J
Non-Ionizing Radiation

Purpose To establish responsibility for the implementation of non-ionizing radiation hazards control.

Non-ionizing radiation sources consist of:

- High intensity light sources.
- Ultraviolet or infrared.
- Ultrasound.
- Radio frequency (RFR).
- Microwave.
- Laser radiation.

Control of non-ionizing radiation hazards is according to ARs 40-5, 385-9, and TB Med 524.

Non-ionizing radiation generates thermal energy, which is absorbed by the body.

When heat dissipates, thermal effects on the body are reversed and effects are not cumulative as in ionizing radiation exposures.

Extreme exposure may produce cataracts, burns, or erythema.

J-1

Environmental Science Officer The Environmental Science Officer, MEDDAC supervises the microwave oven non-ionizing radiation safety program (TB Med 523).

J-2

IRSO The IRSO is the local consulting authority for the non-ionizing radiation protection program and is the Installation Laser Safety Officer (III Corps, ACoS, G1, Safety).

The IRSO:

- Monitor units that are required to maintain a non-ionizing radiation program SOP.
- Provide support and direction to units on non-ionizing issues.
- Conduct required investigations on RFR/laser incidents or accidents.
- Make required notification to higher headquarters.
- Coordinate with HQ, MEDDAC on:
 - Any reported potential exposure to non-ionizing radiation.
 - Ensure that immediate and follow-up medical examinations are provided.

J-3

Dosimeters There are no personnel dosimeters unsuitable or available for monitoring non-ionizing radiation exposure.

J-4

Eye Protection

Laser and welding eye protection are the only suitable or required PPE for non-ionizing radiation exposure.

TB Med 524 provides guidance for the proper use and marking of laser eye wear.

J-5

Radio Frequency Radiation (RFR)

Table J-1. Types of RFR sources.

| RFR Sources | Activities Operating RF Radiating Sources Are | RF Burn |
|--|---|---|
| Radar systems | Signal battalions | An RF burn can occur when RF current enters through a small cross section of the body. |
| Industrial heaters and sealers | Physical therapy clinics in hospitals | Burns can occur at any RF frequency. |
| Radio Sets | Field artillery units | Potential locations for RF burn are antennas, cables, connectors, all RF circuits, and microphones. |
| Electronics Countermeasures Equipment (jammers). | Military intelligence units. | <i>intentionally left blank</i> |
| Satellite Communications (SATCOM) Systems | Air defense sites. | |
| Any other sources which emit RFR. | MARS stations. | |
| RF Diathermy Sets, MRIs | Communications and electronics shops. | |
| | Avionics activities. | |

J-6

Lasers

Light Amplification by the Stimulated Emission of Radiation (LASER)

- Lasers provide light, which can be used to measure distance.
- Lasers are used in
 - Medicine.
 - Biology.
 - Chemistry.
 - Electronics.
 - Wood working.
 - Military.
 - Construction.

Many other fields are being investigated for laser use.

(continued on next page)

**Laser
(continued)**

- Military uses:
 - Target acquisition.
 - Fire control.
 - Training.

These lasers are termed rangefinders, target designators, and direct fire simulators and should be:

- Confined to ranges and/or designated non-live fire training areas.
- Used where no line-of-sight exists between lasers and uncontrolled, potentially occupied areas, and by removing specular surfaces from targets and the area downrange.

J-7

**Hazard
Classification
of Lasers**

Three aspects of a laser application influence the total hazard evaluation and thereby influence the application of control measures:

- Laser device's capability of injuring personnel.
- Environment in which the laser is used.
- Personnel who may be exposed.

Table J-2 discusses categories, classification, hazard controls of lasers:

TB Med 524 shows warning labels and signs, or contact the IRSO for examples.

J-8

Commanders

Commanders

- Publish, post, and enforce SOPs.
- [Ensure persons working in or frequenting any portion of a controlled area know the radiation hazards involved and that they receive proper.](#)
- Maintain an inventory (updated annually) of all non-ionizing radiation producing equipment and provide a copy to the IRSO.
- Ensure controlled areas are properly marked, have proper warning signs, and, where required, have proper warning signals and safety switches (TB Med 521 and 525).
- Report all RFR, laser overexposures or incidents to the IRSO immediately, 287-3329.

J-9

Table J-2. Categories, Classification, Hazard Controls of Lasers.

| Class 1 | Class 2 and 2a | Class 3a and 3b | Class 3b | Class 4 |
|---|---|---|--|---|
| Incapable of producing damaging radiation. | <u>Cannot</u> exceed the AEL for 1000 sec exposure. | Both are direct and specular viewing hazard. | Should have key control. | Direct and specular viewing hazards. |
| <u>Cannot</u> exceed the Acceptable Exposure Limit (AEL) for the maximum possible duration inherent in the design or intended use of the laser. | <u>Not</u> intended for intrabeam viewing. | Diffuse reflection is usually <u>not</u> a hazard. | Should have a beam stop. | Diffuse reflection may present a hazard. |
| Includes laser system with enclosed beam paths. | Hazards comparable to the projectors of the sun. | “Caution” or “Danger” sign required for Class 3a depending on irradiance. | Laser controlled area (danger signs, etc). | May pose a fire hazard. |
| No control measures required. | “Caution” signs required. | | Should have activation warning. | Key control and activation warning required. |
| Examples; • MILES • Tactical Laser Points | | | Medical surveillance required. | Remote inter-lock connector required. |
| | | | “Danger” sign required. | Beam stop required. |
| | | | Example: AN/VVG-31 (M1 LRF). | Laser controlled area “danger” signs required. Examples: AH 64 TADS/PNVS, OH-58D-MMS, AN/TVQ-2 (G/VLLD). |

Appendix K
Transportation of Radioactive Materials

On-Post Transportation It is usually inconvenient to package and transport radioactive materials for on-post movement in the same manner required for off-post shipments.

When transporting radioactive materials on Fort Hood:

- Use only military vehicles.
- Secure radioactive materials in the vehicle to prevent movement.
 - Arrange material so that the dose rate does not exceed 0.5 mr/hr (TB 43-0137) at any point on the external surface of the package.
- Use sturdy containers for transport.
- The radioactive material container must be marked as specified in MIL-STD-129J.
- MIL-STD129J requires that each non-accompanied radioactive material container be marked with "CAUTION- RADIOACTIVE MATERIALS".
- Marking is not required if the package is accompanied by radiation protection personnel.
- Items which contain radioactive material do not require additional markings unless the radiation markings have been removed, damaged or are otherwise indistinguishable.
- Fill out the form at Figure K-1.

K-1

Off-Post Transportation Transport radioactive materials according to applicable DOT regulations, 49 CFR, TM 55-315, TB 43-0131, and FORSCOM Regulation 385-1.

- Radioactive Material Transport Information, Figure K-1 will accompany the shipment.
- CFR.172,403 and 173,444 provide labeling requirements for the transportation of radioactive materials or devices containing radioactive materials.
- Shipping containers will be constructed to meet DOT specification for shipment of radioactive materials (for example, strong, tight container, fiberboard box, seams sealed with tape).
- Get IRSO guidance and approval for all off-post shipments of radioactive material.
- The IRSO will affix appropriate labels to shipping documents, monitor the surface radioactive activity of each package, and furnish Radioactive Materials Movement Form, signed and dated (see Figure K-1).

K-2

**Receipt and
Shipment
of Radio-
active Label**

Upon receipt of a package containing radioactive material and labeled with a Radioactive White I, and Yellow II, or Yellow II label, the central receiving point will contact the IRSO.

If the packaged radioactive commodity is damaged or leaking, the receiving activity can decline acceptance from the transporter or shipper until the IRSO completes monitoring.

- Inform the driver of the transport vehicle that a survey of the vehicle is necessary to establish contamination level, and whether shipper or transporter is responsible for bearing the costs, if any, of decontamination to acceptable limits of vehicle.
- Commercial transporters can decline the Army installation survey, but the item will not be downloaded or received.
- Within three hours of the time of receipt (18 if received after normal duty hours), the IRSO will monitor package and determine if any further action is necessary.
- If the package has a DOT Yellow III label, the IRSO will be notified the package is being unloaded and IRSO will measure dose rates in and around the vehicle if necessary.
- Off-post shipments must comply with regulations established by the DOT, NRC, and affected states in addition to Army regulations.
 - The IRSO must be consulted in the earliest stages of shipment and the IRSO must certify that the package meets all regulatory requirements.

K-3

Figure K-1. Radioactive Materials Movement.

| SHIPMENT | | RECEIPT | SHIPMENT NUMBER |
|---|-----------|---|--|
| TO: | | FROM: | |
| COMMODITY DESCRIPTION | | | MODE OF SHIPMENT |
| CONTAINERS | #OF ITEMS | ITEM | Air Surface Rail Water Parcel Post Other: |
| | | NSN: Nomenclature: | |
| RADIOACTIVITY | | | |
| ISOTOPE | | ACTIVITY | RADIAC LEVELS |
| H3 | Ra 226 | Each _____ Ci, mCi, uCi | Surface |
| Th 232 | Cs 10370 | # of Items x _____ | mrem/hr |
| Kr 85 | Co 60 | TOTAL _____ Ci, mCi, uCi | One Meter |
| Pm 147 | Am 241 | | mrem/hr |
| Other: | | FORM: Sealed Source | Transport |
| | | Solid Liquid | Index |
| TRANSPORTATION INFORMATION | | | |
| <input type="checkbox"/> This package conforms to the conditions and limitations specified in 49 CFR 173.421 for excepted radioactive material, limited quantity N.O.S., UN 2910. <input type="checkbox"/> This package conforms to the conditions and limitations specified in 49 CFR 173.422 for excepted radioactive material, instruments and articles. UN 2910 | | | DOT Labeling |
| | | | _____ Exempt |
| | | | License Number |
| | | | _____ |
| The above named articles are properly classified, described, packaged, marked and labeled, and are in the proper condition for transportation according to applicable regulations of the Department of Transportation. | | | |
| SPECIAL INSTRUCTIONS: In event of an accident, contact the nearest military installation or call: | | 0700-1700 1-254-287-3725 | |
| Signature of Radiation Protection Officer | | | Date |
| Signature of Transportation Officer | | | Date |

Appendix L
Accident and Incident Response Actions

General

The following is provided in the event of a radiation contamination accident and incident:

- Accident response.
 - Stop work.
 - Warn others in the area.
 - Isolate the area.
 - Minimize exposure.
 - Notify the IRSO at 287-3329/3725.
 - **Remember: SWIMN**
- Emergency response (immediate actions not done by the IRSO):
 - Bag the device (contain it).
 - Label the bag to prevent further exposure.
 - Describe the device (NSN, nomenclature, etc.).
 - Write a caution on the bag: "DO NOT OPEN!"
 - Identify yourself (Name, telephone number, etc.).
 - Control the package. Place it in a safe and secure isolated area.
 - Notify the IRSO.
- Emergency response (actions by the IRSO):
 - Ensure that immediate actions have been taken.
 - Ensure current control of the device.
 - Isolate the area where further exposure may occur.
 - Identify personnel who may have been exposed, and may have internal activity.
 - Have a bioassay sample taken, if required (this decision is made only by the IRSO).
 - Must be taken at least four hours after suspected exposure.
 - Conduct a wipe survey of the area.
 - Have wipes analyzed
 - Decontaminate the area if necessary.
 - Notify the licensee, if required.

L-1

Written Report

When an incident involves lost, damaged, or stolen radioactive material, commanders must submit a written report to: Commander, III Corps, ATTN: AFZF-GA-SAFE-G.

- The license agreement requires this information: furnish to the NRC.
- Forward the report through HQ, FORSCOM, to HQ, ACALA, Rock Island, IL.

Commanders will be notified in writing to furnish reports by the IRSO.

- Information required in written reports:

(continued on next page)

**Written
Report
(continued)**

- Description of licensed material involved.
 - Kind.
 - Quantity.
 - Chemical.
 - Physical form.
-
- Description of the circumstances under which the loss occurred.
 - Description of disposition, or probable disposition of the licensed material involved.
 - Exposures of individuals to radiation, circumstances under which the exposures occurred, and the possible total effective dose equivalent to persons in unrestricted areas.
 - Actions taken to recover the material.
 - Procedures or measures that have been or will be adopted to ensure against a recurrence of the event. Identify any common trends if a similar occurrence has occurred at location previously.

Contact the IRSO for assistance if necessary, 287-3329.

L-2

Glossary**Section I. Abbreviations****ACAA**

Automatic Chemical Agent Alarm

ACALA

Army Chemical Acquisition and Logistics Activity

ACOFS

Assistant Chief of Staff

ADR

Automated Data Record

AMC

Army Materiel Command

AMDF

Army Master Data File

Am-241

Americium 241

CALMIS

Calibration Information Management System

CAM

Chemical Agent Monitor

Ci

curies

Co-60

Cobalt-60

Cs-137

Cesium -137

DA

Department of the Army

DARA

Department of the Army Radiation Authorizations

DISCOM

Division Support Command

DODRATTS

Department of Defense Radiation Testing and Tracking System

DOL

Directorate of Logistics

dpm

disintegration per minute

DPW

Directorate of Public Works

DRMO

Defense Reutilization and Marketing Office

DU

depleted uranium

DSU

Direct Support Unit

FORSCOM

Forces Command

FSB

Forward Support Battalion

H3

Tritium

IACTPO

Installation Accountable Property Officer

Laser

light amplification by the simulated emission of radiation

MMCO

Material Management Center Officer

ICRCI

Individually Controlled Radioactive Items

IRCC

Ionizing Radiation Control Committee

IRSO

Installation Radiation Safety Officer

IRPP

Installation Radiation Protection Program

LSO

Laser Safety Officer

LRSO

Local Radiation Safety Officer

MACOM

Major Army Command

mCi

millicuries

MEDDAC

Medical Department Activity

MOS

military occupational specialty

MRS

Muzzle Reference Sensors

MSB

Main Support Battalion

MSC

Major Subordinate Commands

NBC

nuclear, biological and chemical

Ni-63

Nickel-63

NRC

Nuclear Regulatory Commission

NSN

National Stock Number

NTC

National Training Center

PBO

property book officer

Pm-147

Promethium-147

PPE

personal protective equipment

Pu-234/239

Plutonium -239 and -239

Ra-226

Radium 226

radwaste

radioactive waste

RCO

Radiation Control Officer

REM

roentgen equivalent man

RFR
Radio Frequency Radiation

RSO
Radiation Safety Officer

REM
Roentgen Equivalent Man

SCIC
Special Control Item Code

SOP
standing operating procedure

Sr-90
Strontium-90

TB
Technical Bulletin

Th-232
Thorium 232

TLDs
Thermo-luminescent dosimeters

TM
Technical Manual

TMDE
Test, Measurement, and Diagnostic Equipment

uC1
microcuries

UIC
unit identification code

US
United States

1CD
1st Cavalry Division

4ID
4th Infantry Division

13th COSCOM
13th Corps Support Command

4th FSB
4th Forward Support Battalion

15th FSB
15th Forward Support Battalion

27th MSB
27th Main Support Battalion

47th EOD
47th Explosive Ordnance Detachment

115th FSB
115th Forward Support Battalion

204th FSB
204th Forward Support Battalion

404th ASB
404th Aviation Support Battalion

215th FSB
215th Forward Support Battalion

615th ASB
615th Aviation Support Battalion

704th MSB
704th Main Support Battalion

Section II. Terms

Bioassay.
The determination of kinds, amounts or concentrations, and locations of radioactive materials in the human body. This may be by whole-body counting, selected organ counting, or by analysis of materials excreted or removed from the human body.

Controlled Area.
A defined area in which the exposure of personnel to ionizing radiation is under the supervision of an individual in charge of radiation protection. Access is limited.

Installation Radiation Safety Officer (IRSO).
A person designated by the Commander and tasked with the supervision of the radiation protection program of the installation.

Individually Controlled Radioactive Items (ICRI).
Items which may not be acquired by units or activities without a specific license (see Table 1).

Ionizing radiation.
Electromagnetic or particulate radiation capable of producing ions directly or indirectly, in its passage

through matter. Alpha and beta particles, gamma rays, x-rays, and neutrons are examples of ionizing radiation.

Local Radiation Safety Officer (LRSO).

A trained individual, who is responsible for the administration of a unit radiation protection program, that must maintain individually controlled radioactive items required to accomplish their unit's mission (see Table 1). Units that maintain these controlled radioactive sources are Test, Measurement and Diagnostic Equipment activities, units and activities that use the MC-1, Soil Moisture Density Tester, and x-ray equipment (EOD).

Non-Ionizing Radiation.

Radiation less energetic than x-rays, such as ultraviolet, microwave, radio frequency, and laser radiation.

Occasionally Exposed Individual.

An individual whose work is not normally performed in a controlled area and whose duties do not normally involve exposure to ionizing radiation. These individuals may, however, have reason to enter a controlled area in the performance of their duties.

Occupationally Exposed Individual.

An individual whose work is performed in a controlled area and whose duties might involve exposure to ionizing radiation. The term "occupationally exposed individual" is synonymous with the term "radiation worker."

REM (Roentgen Equivalent Man).

A unit of measurement used to quantify the effect of radiation on humans. One REM is the absorbed dose from any type of ionizing radiation that will produce the same biological effect as the absorbed dose of x-ray or gamma radiation.

Thermo-luminescent Dosimeter (TLD).

A device used to measure radiation exposure to an individual occupationally exposed to certain types of radiation.

Tritium (tritiated devices).
 Tritium is the name given to radioactive hydrogen gas (H3). Tritium is often used to provide illumination in devices without requiring light bulbs or electrical

power. The hazard associated with tritium occurs when the device is not illuminating. This means the gas has escaped and tritium oxide residue remains causing radiation contamination.

Section III. Special Terms

This section not used

Table Glossary - 1. Individually Controlled Radioactive Items (AR 11-9, Table 3-1)

| DES and NSN | ISOTOPE and ACTIVITY | SEALED SOURCE | LEAK TEST FREQUENCY (MONTHS) | REFERENCES |
|---|--|---------------|------------------------------|--------------------|
| Radiac Cal AN/DUM-6 6665-00-767-7497 | Pu-239 1.4 uCi | No | 3 | TM 9-6665-214-13&P |
| Radiac Cal AN/UDM-6 6665-00-176-9037 | Sr-Y90 100mCuries | Yes | 6 | TM 1-6665-227-12 |
| MC-1 Soil Moisture Density 6665-01-030-6896 | CS-137 10mCuries AM-241 50mCuries | Yes | 6 | TM 5-6635-386-12&P |

Warning. The items in Table 1 are sources of radiation and can be extremely dangerous. Consult references for safety precautions, warning signs, and storage limitations.