Department of the Army
Pamphlet 385–25

Safety

Occupational Dosimetry and Dose Recording for Exposure to Ionizing Radiation

Headquarters
Department of the Army
Washington, DC
2 October 2012

UNCLASSIFIED

SUMMARY of CHANGE

DA PAM 385–25
Occupational Dosimetry and Dose Recording for Exposure to Ionizing Radiation

This administrative revision, dated 19 October 2012-

- Adds punctuation to ensure requirements for the issue of dosimetry are inclusive (para 3-1*b*(1)).

This new DA pamphlet, dated 2 October 2012--

- Revises emergency exposure dose limits to reflect new Department of Homeland Security recommendations (para 2-6).

- Expands the types of dosimeters used to provide dosimetry support to include alternate Army-approved National Voluntary Laboratory Accreditation Program-accredited dosimetry systems (para 3-1).

- Prescribes new DA Form 7689 (Bioassay Information Summary Sheet (BISS)) with instructions to complete the form (paras 3-6*h*, 3-6k(*1*), 3-6(*1*),4-3, and app C).

- Identifies the radiation safety officer as being responsible for preparing and maintaining records (para 4-1).

- Changes annual reporting requirements to reflect revised U.S. Nuclear Regulatory Commission regulations (para 4-8*a*).

- Adds investigational levels for non-U.S. Nuclear Regulatory Commission licensed materials and radiation-producing devices (para 5-2*b*).

- Provides updated sample of DD Form 1952 (Dosimetry Application and Record of Previous Radiation Exposure) with instructions to complete the form (app B).

- Changes the proponency of occupational dosimetry and dose recording for exposure to ionizing radiation from The Surgeon General to the Director of Army Staff (throughout).

- Reflects a name change from Army Ionizing Radiation Dosimetry Center to the U.S. Army Dosimetry Center (throughout).

- Deletes the requirement to appoint a dose records custodian (throughout).

- Eliminates dosimetry decision trees (throughout).

- Makes administrative changes (throughout).

Headquarters
Department of the Army
Washington, DC
2 October 2012

*Department of the Army Pamphlet 385–25

Safety

Occupational Dosimetry and Dose Recording for Exposure to Ionizing Radiation

By Order of the Secretary of the Army:

RAYMOND T. ODIERNO
General, United States Army
Chief of Staff

Official:

JOYCE E. MORROW
Administrative Assistant to the Secretary of the Army

History. This publication is an administrative revision. The portions affected by this administrative revision are listed in the summary of change.

Summary. This pamphlet supersedes DA Pam 40–18 and provides occupational dosimetry guidance and dose recording procedures for exposure to ionizing radiation.

Applicability. This pamphlet applies to the Active Army, the Army National Guard/Army National Guard of the United States, and the U.S. Army Reserve, unless otherwise stated. It also applies to all active duty Army military personnel at any time, on or off a DOD installation; all Army civilian personnel in a duty status, on or off a DOD installation; all Army contractors; and all persons at any time on an Army installation. This publication is not applicable during mobilization or anytime the U.S. Army adopts a state of readiness directly preparatory to actual or imminent armed conflict in a geographical zone where civilian occupational radiation exposure conditions cannot reasonably be construed to prevail.

Proponent and exception authority. The proponent of this regulation is Director of Army Staff. The proponent has the authority to approve exceptions or waivers to this regulation that are consistent with controlling law and regulations. The proponent may delegate this approval authority, in writing, to a division chief within the proponent agency or its direct reporting unit or field operating agency, in the grade of colonel or the civilian equivalent. Activities may request a waiver to this regulation by providing justification that includes a full analysis of the expected benefits and must include formal review by the activity's senior legal officer. All waiver requests will be endorsed by the commander or senior leader of the requesting activity and forwarded through their higher headquarters to the policy proponent. Refer to AR 25–30 for specific guidance.

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

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

Contents (Listed by paragraph and page number)

*This pamphlet supersedes DA Pam 40–18, dated 30 June 1995.

UNCLASSIFIED

Contents—Continued

Table List

Contents—Continued

Figure List

Glossary

Chapter 1
Introduction

1–1. Purpose

This pamphlet provides occupational dosimetry guidance and dose recording procedures for exposure to ionizing radiation. Guidance includes implementation of the personnel dosimetry element of the occupational radiation protection program (Title 10, Code of Federal Regulations (CFR) parts 19 and 20, 29 CFR 1910.1096, and Department of Defense Instruction (DODI) 6055.08) and assurance that Department of the Army (DA) personnel adhere to guidance and are provided personnel dosimetry and bioassay. Applicable personnel and operations include DA personnel deployed as part of the National Response Framework in response to a nuclear terrorist attack; DA personnel deployed on contingency operations that require availability of radioactive commodities; and installation, activities, and U.S. Army Corps of Engineers (USACE) civil works projects. Joint bases that use DA dosimeters for personnel will comply with this regulation with the additional requirement that dosimetry results will be forwarded to the individual's branch of Service (if individual is not DA personnel). Joint bases that use another Service's dosimetry (Navy or Air Force) will comply with associated regulations and the results of monitoring will be forwarded to U.S. Army Dosimetry Center (USADC) at least annually.

1–2. References

Required and related publications and prescribed and referenced forms are listed in appendix A.

1–3. Explanation of abbreviations and terms

Abbreviations and terms used in this pamphlet are explained in the glossary.

1–4. Waivers and exceptions

a. As a minimum, submit the following information to request a waiver or exception:

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

(2) Reasons why the standard cannot be met.

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

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

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

b. Forward the request for waiver, extension of waiver, or exception through command channels to Headquarters, Department of the Army, Army Safety Office (DACS–SF) 9351 Chapek Road, Building 1456, Fort Belvoir, VA 22060–5860.

c. This pamphlet does NOT cover the following:

(1) Patients exposed to ionizing radiation in the course of medical and dental examination, diagnosis, or treatment. This exception does not apply to the providers of health care, (for example, nurses, doctors, and other medical personnel).

(2) Human research subjects exposed to ionizing radiation in the course of voluntary participation in medical research programs.

(3) Personnel exposed to ionizing radiation as a result of nuclear war.

(4) Personnel exposed to ionizing radiation as a result of combat, peacekeeping, or peacemaking operations for which an alternate ionizing radiation protection standard is implemented in accordance with the North Atlantic Treaty Organization (NATO) or Military Service doctrine.

(5) Personnel exposed to cosmic ionizing radiation, such as air crew who are covered under Federal Aviation Administration guidelines.

(6) Doses received from natural background radiation.

1–5. Procurement

The dosimetry requirements of this pamphlet must be incorporated into the procurement of contractor services initiated after the date of this publication. Preexisting contracts do not require modification.

Chapter 2
Radiation Dose Terminology Overview, Dose Limits, and Guidance

2–1. Radiation dosimetry quantity equivalencies

Table 2–1 provides guidance in determining the equivalency of radiation dosimetry terms and concepts encountered

outside 10 CFR. This DA pamphlet uses the terms and concepts of 10 CFR 20; however, situations arise outside of U.S. Nuclear Regulatory Commission (NRC) purview where other dosimetric concepts and terms are needed.

Table 2–1
Radiation dosimetry quantity equivalencies

Commonly used dosimetry terms in DA Pam 385–25		
10 CFR 20	**ICRP–26[1]**	**ICRP–60/ICRP–103**
Committed dose equivalent (CDE) ($H_{T,50}$)	Committed dose equivalent (H_{50})	Committed equivalent dose ($H_T(50)$)
Committed effective dose equivalent (CEDE) ($H_{E,50}$)	Stochastic effects limit ($T_T w_T H_T$) first defined as "committed effective dose equivalent" in ICRP–42.	Committed effective dose (E(50)) $E(50) = T_T w_T H_{T,50}$
Deep dose equivalent (DDE) (H_d)	Deep dose equivalent ($H_{10\ mm}$)	Individual dose equivalent, penetrating, ($H_p(10\ mm)$)
Lens dose equivalent (LDE)	Lens dose equivalent ($H_{3\ mm}$)	Individual dose equivalent, superficial, ($H_p(3\ mm)$)
Shallow dose equivalent (SDE) (H_s)	Skin dose equivalent ($H_{0.07_{mm}}$)	Individual dose equivalent, superficial, ($H_p(0.07\ mm)$)
Total effective dose equivalent (TEDE) TEDE = DDE + CEDE	Sum of deep dose equivalent and committed effective dose equivalent	Effective dose (tissue-weighted sum of equivalent doses in all tissues and organs of the body)

Notes:
[1] Abbrievation: ICRP=International Commission of Radiological Protection

2–2. Radiation exposure dose limits

The U.S. Army dosimetry program is based on the concept of "as low as reasonably achievable (ALARA)" regarding exposure to radiation. ALARA involves making every reasonable effort to maintain exposures to radiation as far below applicable dose limits as is practically consistent with the purpose for which the activity is undertaken (see DA Pam 385–24).

2–3. Army personnel ionizing radiation exposure standards and dose limits

a. The Army personnel ionizing radiation exposure standards. The Army personnel ionizing radiation exposure standards are found in DA Pam 385–24. The annual ionizing radiation dose received by adult occupationally exposed individuals, except for planned special exposure (PSE), will not exceed table 2–2 (see also DA Pam 385–24).

b. Annual dose limits.

(1) *Adults.*

(a) Dose limits will be the more limiting of the below—

1. Stochastic. The stochastic limit of a TEDE of 5 roentgen equivalent man (mammal) (rem)/year (yr) [50 milliSieverts (mSv/year (y)]. The TEDE is the sum of the DDE (H_d) from external exposure and the CEDE ($H_{E,50}$) from internal exposure.

2. Deterministic. The deterministic (non-stochastic) limit of the sum of the DDE (H_d) and the CEDE ($H_{E,50}$) to any individual organ or tissue, other than the lens of the eye, for an adult occupationally exposed individual must not exceed 50 rem/yr (500 mSv/y).

(b) Lens dose equivalent (LDE) of 15 rem/yr (150 mSv/y).

(c) Shallow dose equivalent (SDE) (H_s) of 50 rem/y (500 mSv/y) to the skin of the whole body or to the skin of any extremity.

(d) In cases of uniform whole body irradiation, where the dose equivalent may be assumed to be the same for each organ, the TEDE is equal to the DDE in the absence of any occupational internal exposure.

(e) Internal radiation exposures from radionuclides through intake or immersion will use the annual limits on intake (ALIs) and derived air concentrations (DACs) published in 10 CFR 20 to limit radiation exposure.

1. Alternative ALIs and DACs may be derived for different chemical or physical forms of radioactive material, when such chemical or physical forms are known.

2. To calculate the CEDE, the licensee may assume that the inhalation of one ALI, or an exposure of 2000 DAC-hours, results in a CEDE of 5 rem (50 mSv) for radionuclides that have their ALIs and DACs based on CEDE.

(2) *Minors.* The annual occupational dose limits for minors (less than 18 years of age) are 10 percent of the annual dose limits specified for adult workers. Occupational dose limits less restrictive than those specified above cannot be applied to minors. In cases of uniform whole body irradiation, where the dose equivalent may be assumed to be the same for each organ, the TEDE is equal to the DDE in the absence of any occupational internal exposure.

(3) *Fetus or embryo of occupationally exposed declared pregnant woman.* The occupational dose limit to a declared pregnant woman is 500 (mrem) (5 mSv) (DDE of mother + CEDE due to radionuclides in fetus or embryo) during the gestation period. Efforts should be made to avoid substantial variation above a uniform monthly exposure rate (50 mrem/month).

(4) *Nursing mothers.* Nursing mothers who are potentially exposed to intake of radionuclides require special consideration to limit the dose to their child. The child is considered a member of the public.

c. Accumulation of doses. The dose limits apply to occupational doses that a person receives from all occupations during the calendar year. Thus, the annual limits apply to the sum of all occupational exposures, not just those at a single place of employment.

d. Overseas standards. Whenever the occupational exposure dose limits specified in this pamphlet or the ALI and DAC values specified in 10 CFR 20 differ from those of the host country, the more restrictive of such limits or values will be used when required under the prevailing Status of Forces Agreement with the host country. It is recommended that host country nationals follow host country regulations on U.S. military installations, and U.S. personnel follow 10 CFR 20 while on U.S. military installations as they are considered Federal property, are typically governed by Federal regulations, and their doses are not tracked by the host nation.

Table 2–2
Army personnel ionizing radiation exposure standards[1]

Category	Maximum [2,3]
Member of the general public	100 mrem (1 milliSieverts (mSv)) (TEDE) in calendar year[4]
Fetus or embryo of occupationally exposed declared pregnant woman	500 mrem (5 mSv) (DDE of mother + CEDE due to radionuclides in fetus or embryo) for gestation period)
Occupational exposure of adults	5 rem (0.05 Sv) (TEDE) in calendar year
Lens of the eye	15 rem (0.15 Sv) (LDE) in calendar year[3]
Individual organ	50 rem (0.5 Sv) (DDE + CDE) in calendar year
Skin or extremity	50 rem (0.5 Sv) (SDE) in calendar year
Occupational exposure of minors under age 18	0.5 rem (0.005 Sv) TEDE in a calendar year
Emergency worker - non lifesaving	5 rem[5]
Emergency worker - lifesaving	25 rem[6]
Emergency worker - lifesaving	50 rem[7]

Notes:

[1] Refer to 10 CFR 20 for detailed standards. For deployment and combat actions, see also Joint Publication (JP) 3–11.

[2] Abbreviations: TEDE = total effective dose equivalent; DDE = deep dose equivalent; CEDE = committed effective dose equivalent; LDE = lens dose equivalent; CDE = committed dose equivalent; SDE = shallow dose equivalent; Sv=Sieverts.

[3] The Occupational Safety and Health Administration (OSHA) standard for occupational exposure of adults and for the lens of the eye is 1¼ rem in calendar quarter (see glossary). The OSHA standard for skin of whole body is 7½ rem in calendar quarter. The OSHA standard for hands and forearms, as well as feet and ankles, is 18¾ rem in calendar quarter.

[4] The dose in any unrestricted area from external sources, exclusive of the dose contributions from patients administered radioactive material, and released in accordance with applicable regulations, will not exceed 2 mrem (0.02 mSv) in any 1 hour.

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

[6] Only on a voluntary basis where a lower dose limit is not practicable.

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

2–4. Guidance to declared pregnant women

a. Commanders of installations and activities possessing ionizing radiation sources and devices will ensure that the dose to an embryo or fetus, due to occupational exposure of a declared pregnant woman, does not exceed 500 mrem (5 mSv) during the entire pregnancy, and should not exceed 50 mrem (0.5 mSv) per month, as per the guidance in 10 CFR 20.1208. The dose to the embryo or fetus is the sum of the DDE for the declared pregnant woman, the dose to embryo or fetus from radionuclides in the embryo or fetus, and the dose from radionuclides in the declared pregnant woman's body.

b. Command policy will aid with the compliance of the occupational dose limits for declared pregnant women, and the commander, radiation safety officer (RSO), the supervisor of the declared pregnant woman, and declared pregnant woman will be involved. The commander, RSO, the supervisor of the declared pregnant woman, and declared pregnant woman will make efforts to maintain the monthly occupational radiation exposure rate ALARA and relatively uniform, that is, free of any substantial dose rate variation above the uniform monthly exposure rate. The RSO will inform females occupationally exposed to ionizing radiation of the different, lower permissible dose limits applicable to the embryo or fetus during pregnancy.

c. The RSO will provide instructions regarding prenatal exposure risks and concerns to the developing embryo or fetus to females occupationally exposed to ionizing radiation. NRC Regulatory Guide 8.13 is typically used to provide this information.

d. A female occupationally exposed to ionizing radiation does NOT fall under the lower annual permissible dose equivalent for declared pregnant women, unless and until she formally declares her pregnancy, in writing, to the RSO. The RSO will then notify the applicable licensee(s) and the USADC. A formal declaration of pregnancy, however, is the prerogative of each pregnant woman. A woman occupationally exposed to ionizing radiation will not be intimidated or coerced to declare, or not declare, a pregnancy.

(1) To declare her pregnancy, the woman will voluntarily provide to the RSO a written statement that is dated, signed, and contains the following information. "I hereby make notification that I am occupationally exposed to radiation in the course of my normal job duties, and that I am now pregnant. My estimated date of conception is (only month and year is needed). I understand that by declaring my pregnancy, my occupational exposure to ionizing radiation will be controlled as prescribed in DA Pam 385–24."

(2) The RSO will maintain a copy of the written declaration on file for the duration of the pregnancy.

e. A declared pregnant woman may revoke her declaration at any time. The revocation will be in writing, and maintained by the RSO.

f. Declaring pregnancy will not, in most cases, remove the declared pregnant woman from her normal duties. The supervisor, in coordination with the RSO, will review the female's prior dose history, and determine whether or not changes in the duties of the declared pregnant woman are warranted based on this review. If changes in duties are necessary, the supervisor and RSO will discuss the rationale with the declared pregnant woman.

g. If the dose to the embryo or fetus exceeds 500 mrem (5 mSv), or is within 50 mrem (0.5 mSv) of this dose by the time the woman declares the pregnancy to the RSO, the installation or activity will be in compliance with the guidelines provided in paragraph 2–3*b* if the additional dose equivalent to the embryo or fetus does not exceed 50 mrem (0.5 mSv) during the remainder of the pregnancy.

2–5. Planned special exposure

a. Guidance on a PSE is provided in 10 CFR 20, and is defined as an infrequent exposure to radiation, separate from and in addition to the annual dose limits.

b. The DA NRC licensee will—

(1) Request a PSE only in an exceptional situation when alternatives that might avoid the dose estimated to result from the PSE are unavailable or impractical.

(2) Calculate estimated doses, provide details, and justify the PSE in writing to The Surgeon General (TSG), Director of Army Safety (DASAF), and NRC if appropriate.

(3) Receive written authorization from TSG and DASAF.

(4) Provide estimated PSE doses to the individuals and USADC within 30 days from the date of the PSE.

2–6. Emergency exposure dose limits

a. In an emergency, it may be necessary for individuals such as firefighters, emergency response workers, or occupationally exposed individuals to exceed the annual limits. In such a situation, the probable risk of high radiation exposure to the first responder will be weighed against the expected benefits. Responders and incident commanders will understand the risks associated with radiation. Nothing in this chapter will be construed as limiting any immediate actions necessary to protect health and safety.

b. Table 2–3 provides emergency exposure dose limit guidelines for activities where exposures below 5 rem cannot be maintained. In these special situations, higher doses may be acceptable to lifesaving measures.

c. The emergency exposure is a once in a lifetime dose, so utilize appropriate personnel as necessary.

Table 2–3
Emergency exposure dose limit guidelines[1]

Total effective dose equivalent guidelines	Activity	Conditions
10 rem (100 mSv)	Protecting valuable property necessary for public welfare (such as, a power plant)	Exceeding 5 rem unavoidable and all appropriate actions taken to reduce dose. Monitoring available to project or measure dose.
25 rem (250 mSv)	Lifesaving or protection of large populations	Exceeding 5 rem unavoidable and all appropriate actions taken to reduce dose. Monitoring available to project or measure dose.
50 rem (500 mSv)	Lifesaving or protection of large populations	Exceeding 5 rem unavoidable and all appropriate actions taken to reduce dose. Monitoring available to project or measure dose. If lifesaving emergency responder doses approach or exceed 50 rem (500 mSv) emergency responders will be made fully aware of both the acute and the chronic (cancer) risks of such exposure.

Notes:

[1] Adapted from Edition 73, Federal Register, Page 45029 (73 FR 45029), Planning Guidance for Protection and Recovery Following Radiological Dispersal Device (RDD) and Improvised Nuclear Device (IND) Incidents.

2–7. Dose limits for individual members of the public

a. Commanders of installations and activities will conduct radioactive material and ionizing radiation-producing device operations so—

(1) The TEDE to individual members of the public from radiation sources under their control does not exceed 100 mrem/yr (1.0 mSv/y) exclusive of—

(a) The dose contribution from any authorized disposal of licensed radioactive material into the sanitary sewerage system in accordance with 10 CFR 20.2003.

(b) Any dose received as a patient from medical or dental procedures, or participation in medical research programs.

(2) The dose in any unrestricted area from external ionizing radiation sources does not exceed 2 mrem (0.02 mSv) in any 1 hour.

b. Authorization to exceed 100 mrem/yr (1.0 mSv/y), but not to exceed 500 mrem/yr, will be requested through command channels, and approved by DASAF prior to exceeding the 100 mrem limit. NRC licensees with coordination and approval from DASAF will request authorization from NRC as per 10 CFR 20.1301.

c. Facilities or installations regulated by Environmental Protection Agency's (EPA's) National Emissions Standards for Hazardous Air Pollutants will limit public exposure per 40 CFR 61.102.

d. If members of the public are permitted to have access to radiation source use areas controlled by the commander of the installation or activity, the applicable dose limits which such members of the public can sustain will remain those specified for the general public.

e. In outside the continental United States facilities where dosimetry is used, it is recommended that host country nationals follow host country regulations on U.S. military installations, and U.S. personnel follow 10 CFR 20 while on U.S. military installations, as they are considered Federal property, are typically governed by Federal regulations, and their doses are not tracked by the host nation.

2–8. Dose limits to occasionally exposed individuals

a. Occasionally exposed individuals are individuals who occasionally enter restricted areas. They will NOT receive a radiation dose in excess of that permitted for any member of the public specified above.

b. These individuals can include such people as messengers, delivery persons, scientists, engineers, managers who witness tests, or inspectors visiting facilities. These individuals normally—

(1) Do not work in a restricted area.

(2) Are not exposed to ionizing radiation as part of their duties.

2–9. Dose limits for transient operations

a. Transient operations or transient practices may exist which require exposure of individuals, who are not normally occupationally exposed individuals, to levels in excess of the 100 mrem (1.0 mSv) annual public limit.

b. Submit a request for approval of these practices, in advance, to the DASAF. For NRC-regulated material, the licensee needs NRC approval to operate up to an annual dose limit of 500 mrem/yr. In any case, the exposure of these individuals will not exceed 500 mrem/yr (5.0 mSv/y). The request will include the following information—

(1) Demonstration of the need for, and the expected duration of, operations in excess of the limit in subparagraph *a*, above.

(2) Documentation of a program to assess and control dose within the 0.5 rem (5.0 mSv) annual limit.

(3) Procedures to be followed to maintain the dose ALARA.

Chapter 3
Personnel Dosimetry Guidance and Procedures

3–1. Conditions for personnel requiring radiation monitoring

a. Radiation safety officers for installations and activities. RSOs for installations and activities possessing radioactive material and ionizing radiation-producing devices will assess exposures to radiation to demonstrate compliance with the occupational dose limits and to effectively support the ALARA concept for good radiation safety program management.

b. External dosimetry. The RSO will issue dosimeters to assess ionizing radiation doses from external sources to the following:

(1) Personnel who are occupationally exposed to ionizing radiation in the course of normal job duties; and

(2) Personnel who have a reasonable probability of receiving the following doses in any 1 calendar year:

(a) Adult occupationally exposed individuals. A dose in excess of 10 percent of the limits or any dose associated with entering high or very high radiation areas.

(b) Minors (less than 18 years of age). Minors will not receive a dose in excess of 10 percent of the annual limits.

(c) Declared pregnant women. Declared pregnant women will not receive a dose in excess of 10 percent of the exposure limits. Issue dosimeters to an occupationally exposed female when she declares her pregnancy in writing to the RSO. The installation or activity command, through the RSO, will provide monthly dosimetry throughout the duration of the pregnancy to determine the extent of compliance with declared pregnant women exposure limits. A fetal dosimeter should be used in addition to whole-body dosimeters. If their normal duties require the routine wearing of a lead apron, and they are provided with both a whole-body dosimeter to be worn under the apron, and a head-and-neck dosimeter to be worn outside the apron at the neck area to monitor exposure to the head, neck, and the lens of the eye, then their fetal dosimeter will be worn under the apron at the abdomen. If they are normally issued a single whole-body dosimeter and choose to wear a lead apron, the whole-body dosimeter will be worn outside the lead apron, and the fetal dosimeter will be worn under the lead apron.

(3) *Firefighters and emergency response personnel in situations where they have the potential to be exposed to radiation.* Firefighters and emergency response personnel will use USADC dosimeters.

(4) *Personnel under U.S. Nuclear Regulatory Commission licenses, Army radiation authorizations, or activities subject to U.S. State/Territory regulatory authority requiring dosimetry.* These personnel will use an Army-approved National Volunteer Laboratory Accreditation Program (NVLAP)-accredited dosimeter that is issued by USADC.

(5) *Personnel who receive exposures from medical x-ray radiation or wear protective apparel (such as, protective apron).* To reduce exposure these personnel will follow the guidance provided below:

(a) The National Council on Radiation Protection and Measurements (NCRP) Report 122 recommends individuals working with medical x-ray radiation, medical fluoroscopic or cardiac catheterization x-ray equipment, exposed to x-rays or NRC-licensed material scattered from the patient, will wear both a head-and-neck dosimeter and a whole-body dosimeter. The whole-body dosimeter is worn under the lead apron, between the waist and the shoulders; for declared pregnant women, over the developing fetus. The head-and-neck dosimeter is worn outside the lead apron around the neck region. The TEDE is calculated by multiplying the recorded head-and-neck dosimeter exposure (C) by 0.04, multiplying the recorded whole-body dosimeter exposure (W) by 1.5, and summing the two (TEDE=0.04C+1.5W). The USADC automatically conducts this calculation, and provides the results from the individual dosimeters and the TEDE calculation. NRC licensees will incorporate this method of effective dose calculation into their procedures and radiation safety program before this method of dose determination can be applied. NRC licensees should refer to NRC Regulatory Issue Summary (RIS) 2002–06, Evaluating Occupational Dose for Individuals Exposed to NRC-Licensed Material and Medical X-Rays, located at Web site hrrp://www.nrc.gov/reading-rm/doc-collections/gen-comm/reg-issues/2002/ri02006.pdf for additional information.

(b) In the practice of radiology involving fluoroscopy and cardiac catheterization, where the occupationally exposed individual (for example, physicians, technicians, and nurses) is NOT behind any protective leaded control booth walls, lead aprons provide significant protection to the majority of the occupationally exposed worker's trunk (whole-body). Lead aprons will, therefore, be worn, and both a head-and-neck and a whole-body dosimeter will be issued to these workers. The eye dose limits will be used to determine if the head-and-neck badge dose limit requires an ALARA investigation. The TEDE dose limit will be used to determine the whole-body dose that will require an ALARA investigation.

(6) *All radiographers and radiographers' assistants.* Individuals associated with the use of ionizing radiation sources used for radiographic purposes will wear dosimetry. Army-approved NVLAP-accredited dosimeter and a self-reading alarming electronic dosimeter will be issued and worn in accordance with 10 CFR 34.47.

(7) *Individuals who operate or use irradiators, both machine-generated and U.S. Nuclear Regulatory Commission-*

regulated devices. Personnel using machine-generated, or NRC-regulated devices are occupationally exposed, and will be provided personnel dosimetry in accordance with the provisions of American National Standards Institute (ANSI) N43.5 and 10 CFR 36. An Army-approved NVLAP-accredited dosimeter will be issued and worn by the irradiator operator. The processor of this dosimeter will be accredited for high energy photons in the normal and accident ranges (see 10 CFR 20.1501(c)). For requirements of other individuals entering a room with an irradiator, see 10 CFR 36. 55(b).

(8) *Individuals who operate or use well logging sources.* Personnel using these devices are occupationally exposed and will be provided personnel dosimetry in accordance with the provisions of 10 CRF 39. An Army-approved NVLAP-accredited dosimeter will be issued and worn by all individuals working with such sources.

c. Internal dosimetry. The RSO will determine the need for monitoring occupational intakes of radioactive material, using Federal regulations and NRC license conditions as guides. The RSO may consult medical personnel for assistance and guidance, as needed. At a minimum, the RSO will assess the CEDE from radioactive material intakes when both of the following criteria are met—

(1) Personnel are occupationally exposed to unsealed radioactive materials in the course of normal job duties.

(2) Personnel have a reasonable probability of receiving the following dose in any 1 year—

(a) Adult occupationally exposed individuals. An intake of radioactive material in excess of 10 percent of the applicable ALIs specified in table 1, columns 1 and 2 of appendix B, 10 CFR 20.

(b) Minors and declared pregnant women. A CEDE in excess of 10 percent of the specified limits in table 1, columns 1 and 2 of appendix B, 10 CFR 20 as per 10 CFR 20.1207 for minors and 10 CFR 20.1208(c)(2) dose equivalent to the embryo or fetus from radioactive sources internal to the body.

3–2. Types of radiation monitoring

a. External monitoring for exposure to beta, gamma, neutron, or x-ray radiation.

(1) *Whole-body monitor.* A whole-body dosimeter is used to monitor the external radiation dose from radioactive materials or radiation-producing devices. The whole-body constitutes the head, trunk (including male gonads), arms above the elbow, or legs above the knee. From the whole-body monitor, the DDE and SDE can be determined.

(2) *Head-and-neck monitor.* The dose from the head-and-neck dosimeter is used to determine the dose to the skin and lens of the eye, providing both a SDE and a LDE. If the eye protection of an occupationally exposed individual wearing eye protection (for example, leaded glasses), provides at least 700 mg/cm^2 thickness, the RSO will annotate on the dosimetry issue listing beside the individual's name "eye protection provided," so that the 1000 mg/cm^2 depth dose will be computed rather than the standard depth of 300 mg/cm^2.

(3) *Wrist monitor.* A dosimeter that is worn on the wrist to determine the dose to the hands or wrists. The DDE and SDE can be determined from the wrist dosimeter.

(4) *Ring monitor.* Ring dosimeters are worn on the third finger of the dominant hand to determine if the hands and fingers have been exposed. Ring dosimeters record the SDE.

(5) *Fetal monitor.* Fetal monitors are to be worn in addition to any previously provided personnel monitoring devices. The monitor should be worn over the developing fetus. See the USADC Customer Handbook at Web site https://cecomsafety.apg.army.mil/safety/rso/tbtmtrs/hbk_dosimetry.pdf for additional information on fetal monitors.

(6) *Self-reading alarming electronic dosimeter.* Electronic dosimeters enhance radiation safety, and are used in addition to USADC-provided dosimetry to provide a real time dose estimate and determine if any radiation limit has been reached. Electronic dosimeters will not be used as an official dose of record; however, they are used to determine if emergency dosimetry processing is necessary.

b. Bioassay.

(1) *In-vitro grab specimen.* An internal grab specimen is used as an investigatory determination if a person is being exposed to radionuclides internally. A 24–hour specimen should be taken if the grab specimen indicated the presence of radionuclides. Routine bioassay specimens should use the grab specimen (for example, nasal swipes, urine, and fecal samples) to determine if personnel are being internally exposed to radionuclides.

(2) *In-vitro 24–hour specimen.* One urine or fecal specimen is taken over a 24–hour period to determine the CEDE.

(3) *In-vivo measurement.* Measurements are performed using detectors to determine radionuclides inside the body.

3–3. Area dosimeters

In some areas where radioactive material or radiation-producing sources or devices are used, individuals may be occupationally exposed to ionizing radiation but not meet the criteria of paragraph 3–1, and consequently, not be provided individual dosimetry. In such areas, the RSO may provide temporary area dosimeters, for a limited period of time, to obtain a representative area dose to confirm that occupational doses to individuals are less than 10 percent of the applicable limits.

3–4. Dosimeter wearing requirements and procedures

a. Regulation. Per DA Pam 385–24, all personnel will complete DD Form 1952 (Dosimetry Application and Record

of Previous Radiation Exposure), before receiving USADC dosimetry or participating in a routine bioassay program. (See para 4–2 for additional information on DD Form 1952.)

b. Form. DD Form 1952 will be completed, whether a dosimeter was issued or not, if personnel are occupationally exposed, to include visitors and transients.

c. Conditions.

(1) To measure an occupationally exposed individual's dose, the issued dosimeter will be worn when there is a potential for radiation exposure. All occupationally exposed individuals issued dosimetry are required to wear their dosimeter(s) during occupational exposure while employed by the DA.

(2) In event of an emergency, all personnel, firefighters, emergency responders to include Army National Guard civil support teams, Chemical, Biological, Radiological, Nuclear and High Yield Explosives Consequence Management Response Force Teams, and medical personnel who respond are required to use USADC issued dosimetry to ensure a dose of record is recorded for the event.

(3) All occupationally exposed individuals issued a dosimeter will ensure correct use and handling. Misleading dose reports and unnecessary investigations may result from improper use.

(4) Malicious exposure of a dosimeter is forbidden. Dosimeter abuse is a misuse of Government property. These acts may result in disciplinary action.

d. Wearing procedure for U.S. Army Dosimetry Center issued whole-body dosimeters.

(1) Occupationally exposed individuals will wear the whole-body dosimeter—

(a) Below the shoulders.

(b) Above the hips.

(c) Outside the clothing.

(d) On the portion or area of the body nearest the radiation source.

(e) With the dosimeter window facing out from the body.

(2) Declared pregnant women will wear the fetal dosimeter at the abdomen over the developing fetus.

(3) Do NOT use an individual's whole-body dosimeter to measure localized exposures. See paragraph 3–4*e* below for information on supplemental dosimeters.

(4) Do NOT attach tape or other substances to the front of the dosimeter beta window. However, a label with the user's name may be placed on the dosimetry hanger on the clear space at the front-top of the device hanger, in accordance with procedures specified in the USADC Customer Handbook.

(5) Do NOT exceed the established wearing period indicated on the dosimeter issue listing. However, in an extenuating circumstance where replacement dosimeters have not yet arrived before the start of the next wearing period, the dosimeters in use can continue to be used until replacement dosimeters arrive. If an extended wearing period is required or occurs, ensure that the revised dates for the longer wearing period are provided on the corresponding dosimeter issue listing.

(6) Store dosimeters only in the RSO-approved storage location at the end of an activity or work day.

(7) Do NOT intentionally expose dosimeters.

(8) Temporary duty travelers should ensure their dosimeters are with their carry-on baggage or on their person, and request a hand inspection of their dosimeter. If the dosimeter is inadvertently exposed as checked or carry-on baggage, the traveler should inform his or her RSO. The additional exposure must be accounted for separately from the dose calculated for the individual's exposure. Typically, the dose to baggage from a checkpoint x-ray system is on the order of 1 mrem (0.01 mSv); the dose to baggage from checked-bag systems range from 10 to 250 mrem (0.1 mSv to 2.5 mSv).

(9) Temporary duty travelers in a group should consolidate their dosimeters and keep them with a control badge when stored and when not in use.

e. Wearing supplemental dosimeters.

(1) The RSO may provide an occupationally exposed individual additional dosimeters (for example, head-and-neck, wrist, and ring) to assess localized occupational dose per paragraph 3–2*a*. The USADC will provide these dosimeters. Additional non-USADC-provided dosimeters may be used, but will not be considered substitutes for official USADC dosimeters. Non-USADC-provided supplemental dosimeters may include—

(a) Pocket ionization chambers.

(b) Self-reading pocket dosimeters with or without alarms.

(c) Other devices which provide localized exposure or exposure rate information.

(2) When an occupationally exposed individual wears a wrist or ring dosimeter, the dosimeter will be worn on the wrist closest to the radiation source, or the third finger of the dominant hand, oriented towards the radiation source, and under any protective gloves.

f. Identification.

(1) Dosimeter holders will display some readily identifiable, temporary individual identification (for example, an individual's name), to ensure that occupationally exposed individuals wear their own dosimeter.

(2) Individuals issued dosimetry will not permanently inscribe the dosimeter holder with a name, number, or other identifying symbol, and will not cover the dosimeter's beta window.

(3) Issued dosimeters are not to be used by personnel other than the designated individual during the wearing period. Immediate supervisors and the RSO will ensure that a designated individual issued a dosimeter is the only individual to use that dosimeter

g. Army-issued dosimeters. Army-issued dosimeters will only be used for the purpose that they are issued. For example, Army-issued dosimeters are not to be worn during non-Army-related off-duty employment (see para 3–4*j)*.

h. Storage. The RSO will approve, in writing, all dosimeter storage locations. Each storage location will—

(1) Be close to the area in which the occupationally exposed individual works, yet outside of the areas where the radiation sources or devices are actually used or located.

(2) Be adequately shielded from ionizing radiation.

(3) Contain a control dosimeter.

(4) Provide a storage area for unattended dosimeters where access is restricted from unauthorized personnel.

i. Dosimetry service.

(1) DA installations or activities will use the Army dosimetry service provided by the USADC.

(2) Government-owned contractor operated facilities (for example, long-term contractors) will use the Army dosimetry service unless specifically exempted by contract.

(3) Local national personnel may use local national dosimeters and dosimetry services with the approval of the Command Radiation Safety Staff Officer (RSSO). The more restrictive of the host nation and U.S. laws will apply.

(4) While the above DA requirements do not preclude the use of supplemental dosimeters as discussed in paragraph 3–4*e*, the use of supplemental dosimeters does not eliminate the use of official USADC-provided dosimeters.

(5) DA installations or activities will use the guidance and instructions provided in the Customer Handbook issued by the USADC to administer their dosimetry program.

(6) For additional information contact Chief, U.S. Army Dosimetry Center (AMSAM–TMD–SD), Building 5417, Redstone Arsenal, AL 35898–5000.

j. Personnel exposure from off-duty employment.

(1) Any military occupationally exposed individual who is performing off-duty employment that involves additional occupational exposure to ionizing radiation will provide copies of his or her occupational dose records to the RSO, as a condition of his or her authorization for off-duty employment. This ensures that the annual 5 rem (50 mSv) dose limit is not exceeded.

(2) Any civilian or nonmilitary individual, whose duty involves occupational exposure to ionizing radiation and whose secondary employment involves additional occupational exposure, will provide copies of his or her off-duty dose records to the RSO.

(3) Individuals will provide these off-duty dose records to the RSO—

(a) No later than 2 months after such records are received by the individual from the off-duty employer.

(b) No later than 4 months following the termination of such off-duty employment, if the conditions in subparagraph 3–4*j*(3)(a) are not met.

(4) The RSO will forward the records of these doses to USADC for inclusion into the individual's lifetime dosimetry records.

(5) In reciprocation, the military RSO will also provide dosimetry results to the off-duty employer upon employee-signed request.

k. Armed conflicts. Any time the U.S. Army adopts a state of readiness directly preparatory to actual or imminent armed conflict in a geographical zone, the dosimetry requirements outlined within this pamphlet will not apply. Use tactical dosimeters (for example, IM–93, DT–236, or UDR–13) during these periods. For additional guidance, refer to Reference NATO Standardization Agreements (STANAG) 2083, Commanders' Guide on the Effects from Nuclear Radiation Exposure During War, and STANAG 2474, Determination and Recording of Ionizing Radiation Exposure for Medical Purposes

3–5. Processing dosimeters

The following guidance will be used for processing dosimeters to ensure dosimetry is completed accurately and in a timely manner.

a. Commanders of units with U.S. Army Dosimetry Center accounts. Commanders of units with USADC accounts will ensure that batches of dosimeters are returned to the USADC within 14 working days following the conclusion of the established wearing period.

b. Organizations with unique exchange out frequencies. Organizations with unique exchange out frequencies other than the standard monthly or quarterly period, based upon NRC or Army radiation authorizations (ARA) requirements, will notify the USADC to ensure the requirements are met.

c. Dosimeter processing time. The dosimeter processing time after the end of the wearing period is 14 working days.

d. Batches of dosimeters. Batches of dosimeters not received by the USADC within 30 working days following the end of a wearing period will be considered overdue.

e. Commander notification. USADC will notify commanders, in writing, when their dosimeter accounts become overdue. USADC will furnish a copy of these notifications to the DASAF.

f. Appropriate licensee notification. USADC will notify appropriate licensees and DASAF of overdue dosimeter accounts that involve their NRC-regulated commodities or materials.

g. Reimbursement requirement. USADC may require reimbursement for the cost of replacement of the dosimeters overdue by more than 60 working days.

h. Dosimeter issues. If a dosimeter is lost, damaged, or the occupationally exposed individual's TEDE cannot be determined, the RSO will use one or any combination of the following methods to estimate a realistic administrative dose:

(1) Calculation of the affected occupationally exposed individual's dose based on occupancy or workload information and radiation exposure levels at the radiation source operator location.

(2) Estimation of the dose measured by a supplemental dosimeter, if a primary dosimeter or official USADC-provided dosimeter is unavailable.

(3) Average of the affected occupationally exposed individual's previous occupational dose for the preceding 6 to 12 months.

Note. Use this method only if the exposure conditions for the period for which the dose is being estimated do not differ significantly from the conditions under which the previous, known doses were sustained.

(4) Estimation from doses accrued by coworkers performing similar duties and having similar exposure opportunities.

i. Assigned administrative dose. If an administrative dose is assigned, the RSO will—

(1) Annotate on the local Automated Dosimetry Report (ADR) that an administrative dose has been assigned.

(2) Indicate the administrative dose determination methods used on the ADR (see para 3–5*h*).

(3) Forward a report to Chief, U.S. Army Dosimetry Center (AMSAM–TMD–SD), Building 5417, Redstone Arsenal, AL 35898–5000. The report should contain the following:

(a) Occupationally exposed individual's full name and full social security number.

(b) Occupational specialty code (for example, military occupational specialty, specialty skill identifier, or DA civilian job series).

(c) Location where the individual is presently working and the USADC dosimetry account code.

(d) Administrative dose assessed.

(e) The type of administrative dose assessed (for example, DDE, SDE, and LDE), as applicable.

(f) Method of determining the administrative dose including the types of dosimeters used (for example, whole-body, head-and-neck, wrist, and ring), and additional information used to determine the administrative dose.

(g) Period of time covered by the administrative dose.

(h) Authenticating signature of the RSO.

(4) Maintain a copy of this administrative dose correspondence sent to the USADC in each occupationally exposed individual's local dosimetry record file until this administrative dose appears on the individual's lifetime dose history.

j. Doses potentially exceeding Level III. Doses potentially exceeding Level III in table 5–1 or table 5–2 will follow procedures in paragraph 5–5.

3–6. Bioassay measurements and internal dose assessment requirements and procedures

a. Bioassay measurements and internal dose assessments are made as described in paragraph 3–1*c*, or—

(1) When the types and quantities of radioactive material licensed for use at the facility could, under normal operational occurrences, result in airborne levels in normally occupied areas exceeding 10 percent of the ALI (200 derived air concentration hours (DAC-hours)) as per 10 CFR 20.1502.

(2) To confirm the adequacy of radiological controls (such as, engineering principles and calculations, and respiratory protection).

(3) To determine compliance with occupational dose limits.

(4) When a NRC license requires it.

(5) When an individual may have received a significant exposure from an incident, or to support the ALARA concept.

b. Elements to be considered when establishing a bioassay program include—

(1) Potential exposure pathways to the individual.

(2) Retention and excretion characteristics (chemical and physical form) of the radionuclide.

(3) The sensitivity of the measurement technique needed to achieve these values.

(4) Uncertainties in the estimates of intake and internal radiation doses.

c. Per DA Pam 385–24, all personnel will complete DD Form 1952 (Dosimetry Application and Record of Previous

Radiation Exposure) before receiving USADC dosimetry or participating in a routine bioassay program (see para 4–2 for additional information on DD Form 1952).

d. The frequency of bioassay measurements is based upon the exposure potential, the physical and chemical characteristics of the radioactive material, and the route of entry into the body. The RSO will determine the type and frequency of internal exposure assessments.

e. When an occupationally exposed individual meets or exceeds the criteria specified in paragraph 2–3, the RSO will assess the individual's internal radiation dose by measuring:

(1) Concentrations of radioactive materials in air in work areas.

(2) Quantities of radionuclides in the body.

(3) Quantities of radionuclides excreted from the body.

(4) Combinations of the measurements listed in subparagraphs (1), (2), and (3), above.

f. A variety of radionuclides may be used in research facilities. The potential for exposure to more than 10 percent of the ALI will be evaluated on a case-by-case basis. In particular, the RSO will determine the need, if any, for air monitoring and bioassay for individuals working with low energy beta emitters or alpha emitters. Low energy beta emitters include isotopes such as hydrogen–3 (tritium), carbon–14, sulfur–35, calcium–45, and nickel–63.

g. Provisions will be made for the collection of appropriate samples, analysis of bioassay samples, and evaluation of the results of these analyses, to determine intakes and internal radiation doses. Guidance can be found in 10 CFR 20; 10 CFR 35; and NRC Regulatory Guides 8.9, 8.11, 8.15, 8.20, 8.22, and 8.32. Army guidance can be found in U.S. Army Institute of Public Health (USAIPH) Technical Guide (TG) 211.

h. The USADC DA Form 7689, (Bioassay Information Summary Sheet (BISS)) will accompany all bioassay specimens. Part A of the DA Form 7689 will be completed by the RSO or person responsible for collecting the specimen, and submitted with all bioassay specimens (see para 4–3 for additional information on the DA Form 7689).

i. The analytical laboratory will forward the analytical results of the bioassay analyses to the RSO and others the RSO designates, to include supervisors, and the Command RSSO, to receive the results.

j. The analytical results of the bioassay analyses will include an estimate of uncertainty.

k. The NRC-licensed RSO or health physicist will convert bioassay analytical data to radiation doses following the recommendations in ANSI N13.30. Any NRC-accepted technique or software can be used to perform the dose calculation. NRC 10 CFR 20 requires a calculation to be performed if an intake is greater than 10 percent of the ALI, or the exposure is greater than 10 percent of the DAC.

(1) The RSO will send a copy of the analytical results of the bioassay analyses, internal dose assessments, all supporting documentation, and the completed (Parts A and B) DA Form 7689 to the USADC for inclusion in the individual's lifetime dose record.

(2) The RSO will ensure intakes and internal radiation doses are included in all occupationally exposed individuals' NRC Form 5 (Occupational Dose Record for a Monitoring Period).

l. USAIPH provides bioassay specimen analyses, following the recommendations in ANSI N13.30, and internal radiation dosimetry assessment services to DA installations and activities on a cost reimbursable basis. Bioassay specimens are submitted through local medical treatment facilities to USAIPH. DA Form 7689, with Part A completed, will be submitted with each bioassay specimen sent to USAIPH for analysis (see para 4–3).

(1) For information regarding bioassay analyses and internal radiation dosimetry assessment services, contact the USAIPH Health Physics Program at U.S. Army Public Health Command (MCHB–TS–OHP), 5158 Blackhawk Road, Aberdeen Proving Ground, MD 21010–5403, Commercial: (410) 436–8396 or DSN: 584–8396, e-mail: chppm-hpp-webrequest@amedd.army.mil.

(2) For information regarding bioassay sampling materials, collection procedures, sample shipping requirements, and other laboratory related issues, refer to USAIPH TG 211 or contact the USAIPH Directorate of Laboratory Services at U.S. Army Institute of Public Health (MCHB–TS–LID) (Sample Management Laboratory), 5158 Blackhawk Road, Aberdeen Proving Ground, MD 21010–5403, Commercial: (410) 278–3714 or DSN 298–3714, FAX: (410) 436–4108 or DSN 584–4108, Web site: http://phc.amedd.army.mil/topics/labsciences/rccc/Pages/default.aspx.

(3) For after hours support, the Deputy Chief of Staff Operations, Emergency Operations Center at USAIPH can be reached at Commercial: (410) 436–7301 or DSN: 584–7301.

(4) Before considering contracting for bioassay services, the DA installation or activity will notify DASAF for contract technical review. Consideration will be given to the laboratory requirements discussed here, and how the analytical results will be assessed to determine internal radiation doses. If the DA installation or activity elects to contract for bioassay service from a non-DA activity, the contract will stipulate that the laboratory providing bioassay services will be certified by the clinical laboratory improvement program, and follow the recommendations in ANSI N13.30. If a DOD laboratory or non-DOD laboratory provides the bioassay services, it will be clinical laboratory improvement amendments certified and accredited by a third party organization, such as Commission on Office

Laboratory Accreditation, a clinical laboratory accreditation organization, or the College of American Pathologists. DASAF can assist with determining contract requirements.

Chapter 4
Dose Reporting and Recording Procedures

4–1. Responsibility for dose records
The RSO is responsible for preparing and maintaining accurate records of occupational exposure to ionizing radiation.

4–2. DD Form 1952 (Dosimetry Application and Record of Previous Radiation Exposure)
Per 10 CFR 20.2104(f), licensees are required to maintain records of occupational exposure on either NRC Form 4 (Cumulative Occupational Exposure History) or an equivalent form. DA personnel are required to use DD Form 1952 (Dosimetry Application and Record of Previous Radiation Exposure) to document previous occupational ionizing radiation history. In addition to exposure, DD Form 1952 documents initial training provided to all personnel requiring dosimetry in accordance with DA Pam 385–24. The type of dosimetry provided to the occupationally exposed individual is also included on DD Form 1952 (see app B for completion instructions and an example of DD Form 1952).

4–3. DA Form 7689 (Bioassay Information Summary Sheet (BISS))
a. Purpose. The DA Form 7689 will be completed when bioassay specimens are collected and provided to the analysis laboratory, and when the internal dosimetry results are submitted to the USADC.

b. Completion procedures.

(1) The information in Part A will be used by the laboratory analyzing the data. The RSO or person responsible for collecting the specimen will fill out Part A. Check with the analyzing laboratory if there are questions on how to properly fill it out.

(2) Once the dosimetry assessment is complete, the RSO will fill in Part B and submit the DA Form 7689, along with the data of the bioassay specimen, to the USADC. USADC will include the results into the individual's dose records as the CEDE, which will be summed with the DDE for the TEDE. NRC 10 CFR 20 requires a calculation to be performed if an intake is greater than 10 percent of the ALI, or the exposure is greater than 10 percent of the DAC.

c. Sample form. See appendix C for an example of the DA Form 7689.

4–4. Automated dosimetry record
a. The U.S. Army Dosimeter Center duties include—

(1) Providing a complete occupational dose history as reflected by current repository file information for each occupationally exposed individual upon written request from the RSO.

(2) Providing calendar year-to-date updates on a quarterly basis.

(3) Maintaining dose records of—

(a) Whole body and skin of the whole body.

(b) Head and neck.

(c) Hands and forearms.

(d) Feet and ankles.

(e) Lens of the eye.

(f) Dose to the fetus.

(g) Bioassay data if known.

b. Radiation safety officer duties include—

(1) Verifying that all ADR-related information is contained in the ADR. The RSO and USADC will correct any errors by written correspondence.

(2) Signing and dating the ADR to certify the information as the occupationally exposed individual's official dose record.

(3) Reviewing and certifying each of the USADC updates, and adding them to each occupationally exposed individual's record. Upon receipt of the current calendar quarter update, the previous update may be destroyed. The 4th quarter report includes all dose data for the entire year and will be retained by the RSO.

4–5. Record retention
a. The USADC serves as the Central Dosimetry Records Repository for all dosimetry-related records.

b. The ADR, DD Form 1952, and bioassay results will be maintained by the RSO for the duration of employment of the occupationally exposed radiation worker. The records will be kept until they are no longer required for conducting business, but not to exceed 6 years after the radiation worker has left the position as per AR 25–400–2.

c. The RSO will review all ADRs, and provide corrections to the USADC promptly.

d. The USADC will permanently retain all raw dosimeter readings obtained from personnel badges. In addition, for personnel thermoluminescent dosimeters (TLDs), permanently retain the glow curve data for those TLD dose readings that require notification of TSG, bioassay results, and internal radiation dose assessments.

e. The USADC will—

(1) Retain these data on a media that can be processed by electronic data processing equipment.

(2) Permanently maintain databases containing the records of exposure of past and present employees of DA or Government-owned contractor operated employees in their entirety on a media that can be processed by electronic data processing equipment.

(3) Scan paper records electronically in to Army Records Information Management System (ARIMS); then dispose of the paper records as per guidance in AR 25–400–2. (See the ARIMS link https://www.arims.army.mil/ARIMS/App/MainPage.aspx and para 4–6 for additional guidance.)

4–6. Record disposition

Refer to AR 25–400–2 for radiation safety for record disposition requirements at https://www.arims.army.mil/ARIMS/App/MainPage.aspx. The radiation safety dosimetry files are in the 900A Emergency and Safety folder with disposition times from 0-6 years for local dosimetry files. The RSO should define the period the dosimetry records need to be kept based upon their program to include any NRC regulatory requirements. Recommend keeping the records as long as needed locally, but the USADC is the repository of all Army dosimetry records.

4–7. Employment termination dose reports

a. When an occupationally exposed individual terminates his or her employment from the U.S. Army, the RSO will—

(1) Provide a written dose report to such individuals within 30 days after the termination, or within 30 days of when the dose for the final dosimeter wearing period is determined (whichever is later).

(2) Ensure that the occupationally exposed individual's termination includes appropriate identifying data, such as a full social security number, and dates and location of employment.

(3) Ensure that the report contains—

(a) The results of any calculations and analyses of any radioactive material deposited in the body, if applicable.

(b) The name of the installation or activity that provided the individual dosimetry.

(c) The individual's name and full social security number.

(d) The individual's exposure information.

(e) The following statement: "This report is furnished to you under the provisions of the Nuclear Regulatory Commission regulation (10 CFR 19) or Department of Labor regulation (29 CFR 1910). You will preserve this report for further reference."

b. In accordance with DODI 6055.08, provide the termination dose report to either the former occupationally exposed individual, or to the individual's designee.

4–8. Disclosing information on records

a. Annual reports for U.S. Nuclear Regulatory Commission-licensed materials. The USADC provides annual reports (NRC Form 5 and ADR) on each individual (monitored by external or internal dosimetry) to the RSO. The RSO will provide the individual's annual report of occupational dose to each individual who received more than 100 mrem (1 mSv) or upon request. In accordance with 10 CFR 19.13, 10 CFR 20.2206, or 29 CFR 1910.1096(n)(1) the annual occupational dose report will include—

(1) The name of the installation or activity at which the individual was provided personnel dosimetry.

(2) The individual's name and full social security number.

(3) The individual's exposure information.

(4) The following statement: "This report is furnished to you under the provisions of the Nuclear Regulatory Commission regulation (10 CFR 19) or Department of Labor regulation (29 CFR 1910). You will preserve this report for further reference."

b. Annual reports for radiation exposures not covered under U.S. Nuclear Regulatory Commission licenses. The USADC provides annual ADRs on each individual (monitored by external or internal dosimetry) to the RSO. The RSO will advise each individual in the dosimetry program on his or her exposures on at least an annual basis. In accordance with 29 CFR 1910.1096(n)(1) the annual occupational dose report will include—

(1) The name of the installation or activity at which the individual was provided personnel dosimetry.

(2) The individual's name and full social security number.

(3) The individual's exposure information.

(4) The following statement: "This report is furnished to you under the provisions of the Nuclear Regulatory

Commission regulation (10 CFR 19) or Department of Labor regulation (29 CFR 1910). You will preserve this report for further reference."

Chapter 5
As Low As Reasonably Achievable Investigational Levels, Reportable Dose Criteria, Investigations, and Potential Overexposures

5–1. Reporting guidance

a. This chapter provides information on exposures requiring investigations and reporting using the ALARA investigation levels (ILs) and the annual limits.

b. Ionizing radiation exposure reporting will be accomplished per NRC requirements, as stated in 10 CFR 20.2202 for NRC-licensed radioactive materials.

c. Ionizing radiation exposures resulting from radionuclides or radiation-producing devices not covered under NRC licenses will be reported in accordance with the OSHA regulation 29 CFR 1910.1096.

d. DA guidance on reporting ionizing radiation accidents is provided in this pamphlet, AR 385–10, DA Pam 385–24, and DA Pam 385–40.

5–2. As low as reasonably achievable investigational levels

a. The ALARA ILs specified for NRC-licensed materials are in table 5–1. The levels listed in table 5–1 represent doses that, if continued for the entire year, would exceed the stated percentage of the annual limit. (For example, a monthly whole-body dose of 41 mrem would be a Level I ALARA investigation. If that dose is received each month for 1 year it would represent an approximate dose of 500 mrem, or 10 percent of the 5,000 mrem (5 rem) limit.) DA activities with a NRC license may set their own ILs. The activity specific ILs must be approved by the NRC-licensed RSO and the radiation safety committee, if a committee exists.

b. For non-NRC-licensed materials and radiation-producing devices covered under OSHA regulations, the ALARA ILs are provided in table 5–2. The ILs can be changed either up or down based on specific program needs as determined by the RSO, or other qualified health physics professionals.

c. If an activity has both NRC-licensed and non-NRC-licensed materials, table 5–1 will be used for the investigation levels.

d. For minors, 10 percent of the ILs should be used.

e. Declared pregnant women are not to be covered under these ILs. However, monthly IL I of 41 mrem is consistent with keeping the dose to declared pregnant woman less than 50 mrem per month and in compliance with the regulations.

f. The RSO will have to determine the amount of exposure that is the result of NRC-licensed materials, non-NRC-licensed materials, or the combination of the two. Once the exposure is determined, the specific reporting criteria to the NRC or OSHA will be followed. If a determination is not able to be made, NRC reporting will be used.

g. Investigations can be initiated either:

(1) If a worker, coworker(s), supervisor, or RSO suspects that a radiation dose greater than those specified in the ILs has been received.

(a) The RSO will identify, in writing, dosimeters known to have been used under non-occupational, emergency conditions, or those suspected to have sustained a potential overexposure, when sending such dosimeters to the USADC for processing.

(b) When internal exposure indicators (for example, bioassay results and air samples) suggest potential internal radiation doses in excess of IL II, the RSO will perform, or request, one or more confirmatory bioassay specimen collections to be analyzed and used to assess the internal dose.

(c) When an intake of soluble uranium whose enrichment is less than 5 percent by weight exceeds 10 mg, the event will be considered a potential overexposure, and investigated as per paragraph 5–5. One or more confirmatory bioassay specimens will be collected, analyzed, and used to assess the internal dose.

(d) Guidance on bioassay specimens can be found in USAIPH TG 211.

(2) When external or internal dosimetry results are above the ILs.

(a) The USADC will record on the ADR a person's dosimeter result that exceeds the applicable ALARA IL II, and report the results to the individual's unit or local RSO. ALARA IL II values can be found in table 5–1 or table 5–2.

(b) The unit or local RSO will ensure that appropriate bioassays specimens are taken on the exposed individuals. Using the bioassay results, the unit, local RSO, or equally qualified person can use an appropriate bioassay to dose conversion analysis method to determine the individual's internal radiation dose.

h. When an installation or activity has individuals who are occupationally exposed to both external and internal radiation sources, the ILs identified under the ALARA program will be specified in terms of the TEDE by taking into account the sum of the—

(1) DDE from external sources.

(2) CEDE from internal radiation sources.

(3) External and internal radiation doses derived from ICRP–26, ICRP–60, ICRP–103, or other radiation protection dosimetry system.

i. In cases where there is an approved radiation work permit, the ILs may be waived if controls are in place to ensure the workers do not exceed the annual limits.

Table 5–1
U.S. Nuclear Regulatory Commission as low as reasonably achievable investigational levels (mrem)[1,2, 3]

Quarterly monitoring			
Dose type	**Level I (10% of annual limit)**	**Level II (30% of annual limit)**	**Level III (100% annual limit)**
Whole-body[4]	125	375	1,250
Lens of the eye	375	1,125	3,750
Other[4]	1,250	3,750	12,500
Monthly monitoring			
Dose type	**Level I (10% of annual limit)**	**Level II (30% of annual limit)**	**Level III (100% annual limit)**
Whole-body[4]	41	125	417
Lens of the eye	125	375	1,250
Other[5]	416	1,250	4,166

Notes:

[1] All values rounded down to the nearest mrem.

[2] Action levels for some forms of uranium may be based upon their chemical toxicity rather than radiological properties (NRC Regulatory Guide 8.31).

[3] Facilities which produce radioactive effluents should also consider NRC Regulatory Guide 8.37.

[4] TEDE.

[5] Other includes: SDE to the skin or to any extremity, or the sum of the DDE and the CEDE to any individual organ or tissue other than the lens of the eyes.

Table 5–2
Occupational Safety and Health Administration as low as reasonably achievable investigational levels (mrem)[1,2,3]

Quarterly monitoring			
Dose type	**Level I (10% of annual limit)**	**Level II (30% of annual limit)**	**Level III (100% annual limit)**
Whole-body: Head and trunk; active blood-forming organs; lens of eyes; or gonads	125	375	1,250
Hands and forearms; feet and ankles	1,875	5,625	18,750
Skin of whole body	750	2,250	7,500
Monthly monitoring			
Dose type	**Level I (10% of annual limit)**	**Level II (30% of annual limit)**	**Level III (100% annual limit)**
Whole-body: Head and trunk; active blood-forming organs; lens of eyes; or gonads	41	125	417
Hands and forearms; feet and ankles	625	1,875	6,250

Table 5–2
Occupational Safety and Health Administration as low as reasonably achievable investigational levels (mrem)[1,2,3]—Continued

Skin of whole body	250	750	2,500

Notes:

[1] All values rounded down to the nearest mrem.

[2] Action levels for some forms of uranium may be based upon their chemical toxicity rather than radiological properties (NRC Regulatory Guide 8.31).

[3] Facilities which produce radioactive effluents should also consider NRC Regulatory Guide 8.37.

5–3. As low as reasonably achievable investigational dose reporting

a. Local installations and activities can specify what actions, in addition to those required by this pamphlet, are required of the RSO when an individual's quarterly or monthly dose exceeds any of the ILs.

b. If monitoring periods other than monthly or quarterly are used, the ILs shall be adjusted accordingly for the monitoring period to result in annual doses for Levels I, II, and III at 10 percent, 30 percent, and 100 percent of the occupational dose limits, respectively. At a minimum, such actions shall follow the guidance in the U.S. Nuclear Regulatory Commission Regulation (NUREG) 1556, Consolidated Guidance About Materials Licenses, and this pamphlet.

c. Table 5–3 provides notification, reporting requirements, and suspense guidance for investigational dose criteria. Paragraph 5–4 provides details on ALARA investigations, and paragraph 5–5 provides details on potential overexposures above the annual limits.

d. The unit or local RSO or NRC-license holder, with the support of the USADC, must track all actions, to include investigations, corrective actions, reporting, and follow-up, to ensure they are completed in a timely manner so that similar exposures in the future will be minimized.

Table 5–3
Army investigation dose reporting summary

Dose level	Notification(s)	Notification timeframe	Supplemental report(s)
Level I investigation - At or above Level I limits, but less than Level II limits	-Unit or local RSO	Informal investigation by the RSO	Review of ALARA program, noted in ADR
Level II investigation - At or above Level II limits, but less than Level III limits	-Unit or local RSO -Installation RSO -Headquarters RSSO	Notification within 30 working days of receipt of ADR	Written report within 30 days after notification from the USADC or unit or local RSO
Level III investigation - At or above Level III limits, but less than the annual limit	-Unit or local RSO -Installation RSO -Headquarters RSSO -NRC license holder (if applicable) -ARA manager (if applicable) -DASAF -TSG	Notification within 7 working days of receipt of ADR	Written report within 30 days after notification from the USADC or unit or local RSO
Potential Overexposure investigation - Above the annual limit	-Unit or local RSO -Installation RSO -Headquarters RSSO - USADC NRC license holder (if applicable) -ARA manager (if applicable) -DASAF -TSG -NRC or OSHA	Immediate notification	Verbal notification to the NRC Operations Center and a written report within 30 days after notification as per 10 CFR 20.2201 by licensee, or notification of the Assistant Secretary of Labor as per 29 CFR 1910.1096 by the Headquarters RSSO. The written report by the RSO will be provided within 20 days to the NRC licensee or ARA manager for staffing and submission to the applicable Federal agency.

5–4. As low as reasonably achievable investigation procedures

a. Level I investigation. If a suspected exposure meets or exceeds Level I but is less than Level II, an informal internal investigation of the ALARA program is conducted by the unit or local RSO.

(1) The unit or local RSO will determine the validity of the radiation dose and, if verified, consider process improvements. At a minimum the unit or local RSO will—

(a) Confirm the dosimeter was issued and worn correctly.

(b) Ensure the dosimeter was being worn when exposed.

(c) Review the procedures, working conditions, and ALARA program to determine cause of potential elevated exposure levels.

(d) Provide guidance and recommendations to supervisors and employees.

(e) Provide training, if needed.

(2) If subsequent exposures continue to exceed the Level I ILs, then procedures for a Level II investigation will be followed.

b. Level II investigation. If a suspected exposure meets or exceeds Level II but is less than Level III, this is a reportable dose in accordance with table 5–3, and a formal investigation will be conducted by the unit or local RSO. The unit or local RSO will—

(1) Follow all of the actions required for a Level I investigation.

(2) Report the dose to the headquarters RSSO and the installation RSO within 30 days of receiving the ADR or bioassay results.

(3) Document the investigation in a written report which will include—

(a) Investigation procedures.

(b) Root causes.

(c) Corrective actions.

(d) Results and follow-up.

(4) Provide the report of the investigation to the headquarters RSSO with a copy for the installation RSO within 30 days from when the dose was reported. Follow-up by the headquarters RSSO will be performed in a timely manner to ensure all corrective actions have taken place to reduce the risk of future exposure occurring.

(5) Maintain the investigation records as per AR 25–400–2.

c. Level III investigation. If a suspected exposure meets or exceeds Level III, this is a reportable dose in accordance with table 5–3 and a formal investigation will be conducted by the unit or local RSO. The unit or local RSO will—

(1) Follow all of the actions required for Level II investigation.

(2) Report the dose to the headquarters RSSO, installation RSO, NRC licensee or ARA manager, DASAF, and TSG within 7 days of receiving the ADR or bioassay results.

(3) Remove the occupationally exposed individual(s) from duties which could lead to reportable overexposures pending completion of the investigation. The results of the investigation shall determine when the individual(s) can return to duties involving potential exposure to ionizing radiation.

(4) Provide the written investigation report to the headquarters RSSO, installation RSO, NRC licensee or ARA manager, DASAF, and TSG within 30 days from when the dose was reported.

d. Administrative dose. If the investigation proves that the dose was not a valid personnel exposure (for example, only the dosimeter was exposed), an administrative dose will be assigned as per DASAF review and approval if above a Level III, or by a qualified RSO or health physicist if less than Level III. Guidance on assigning an administrative dose is in paragraphs 3–5*h* and 3–5*i*.

5–5. Actions for potential overexposures above the annual limits

a. This section covers actions that must be followed in the event of exposures greater than the annual limits. This situation could arise from the following cases:

(1) When a dosimeter is analyzed at the end of the established wearing period and the recorded dose on the ADR is greater than the annual limits.

(2) When bioassay results are converted to dose and the reported dose is greater than the annual limits.

(3) The TEDE from the sum of the external dosimetry dose and the internal bioassay dose results are greater than the annual limits.

b. The USADC must immediately report to the unit or local RSO, NRC licensee or the ARA manager, DASAF, and TSG any personnel dosimeter results that exceed the Level III values found in table 5–1 or table 5–2. These dosimeters may indicate exposure conditions that could result in annual doses that exceed NRC, OSHA, or DA limits.

c. The DASAF will forward the dosimeter results through command channels to the individual's location where the potential overexposure occurred.

d. For dosimeters with a reading of a reportable radiation dose at a rate in excess of the quarterly or monthly values specified for Level III, table 5–1 and table 5–2, the RSO will—

(1) Add the reported dose to the individual's accumulated dose for the year. If the individual's accumulated dose exceeds the annual dose limit, the RSO should recommend immediate removal of the individual from his or her duties involving further exposure to ionizing radiation. The results of the investigation shall determine when the individual can return to duties involving potential exposure to ionizing radiation.

(2) Conduct an investigation and determine the cause, timeframe, and circumstances surrounding the potential overexposure.

(3) Determine whether or not the dosimeter was actually worn by the occupationally exposed individual during the dosimeter wear period.

(4) Immediately notify the licensee if NRC-licensed materials were involved or the ARA manager if non-NRC-licensed materials or radiation-generating devices caused the exposure.

(5) Correct or recommend to the commander (for example, brigade or battalion level) that is responsible for the radiation safety program, corrective actions to prevent recurrence of the situation.

(6) Fully document the investigation. The written investigation report must contain:

(a) A copy of the affected occupationally exposed individual's ADR covering the previous 12 months of exposure, if available.

(b) Statements from supervisors or other knowledgeable personnel.

(c) A statement from the affected occupationally exposed individual stating: "To the best of my knowledge and belief I (did) (did not) receive this dose because (state reason)."

(d) Procedures describing corrective actions.

(7) Perform an ALARA review of the duties performed by the worker who is issued dosimetry to reduce the likelihood of recurrence and minimize future doses.

e. When the result of an investigation reveals an exposure in excess of the annual limits, the RSO will—

(1) Notify the immediate supervisor if the exposure exceeds the annual limit.

(2) Recommend immediate removal of the individual from duties involving potential exposure to ionizing radiation.

(3) Follow 10 CFR Parts 20, 34, 35, 36, 39, and 40, as applicable, appropriate NRC regulatory guides, and this pamphlet, as applicable, regarding reporting of any overexposures for occupationally exposed individuals regulated under an NRC-license to the NRC. Follow the OSHA reporting requirements in 29 CFR 1910.1096 for non-NRC licensed radioactive materials or machine-generated radiation. Local national personnel outside the continental United States will follow the more stringent of U.S. or host nation law. Ensure all reporting requirements in this pamphlet, AR 385–10, DA Pam 385–24, and DA Pam 385–40 are followed when reporting.

(4) All incidents and accidents involving an exposure that results in a lost time injury, or an injury requiring medical treatment that causes 1 or more days away from work (includes limited work activities) are also reportable to DA using the DA Form 285–AB (U.S. Army Abbreviated Ground Accident Report (AGAR)). This includes individuals that have reached their 5 rem occupational exposure limit. In addition to the DA Form 285–AB, these individuals must be listed in the OSHA Form 300 (Log of Work-Related Injuries and Illnesses).

f. If medical follow-up is required, the supporting occupational health physician and local RSO will determine the appropriate (if any) medical examinations and medical or laboratory tests, including any bioassay procedures, necessary to document potential short-term or long-term health hazard or injury.

g. The RSO will—

(1) Forward the investigation report within 20 days after the overexposure event as follows:

(a) Where an NRC license is not involved, forward through command channels to the ARA manager for concurrence and transmittal to DASAF and TSG.

(b) Where an NRC license is involved, forward through command channels to the Army NRC license manager for concurrence and transmittal to DASAF and TSG, as applicable.

(2) Maintain the investigation records as per AR 25–400–2.

(3) Provide to the exposed individual the final investigation report including any revisions made to the individual's reported dose.

h. The NRC licensee or the ARA manager has 10 days to staff the report to ensure the completed report is provided within the 30 day reporting time frame to the required Federal agency.

i. The OTSG will provide the DASAF, unit or local RSO, and NRC license manager or ARA manager, the approved dose to be officially posted to the affected occupationally exposed individual's dosimetry record.

Appendix A
References

Section I
Required Publications

Unless otherwise stated, all publications are available at the APD Web site http://www.apd.army.mil/. Department of Defense regulations are available at: http://www.dtic.mil/. Federal Acquisition Regulations are available at http://www.acquisition.gov/far/. Code of Federal Regulations is available at http://www.gpo.gov/fdsys/.

AR 25–400–2
The Army Records Information Management System (ARIMS) (Cited in paras 4–5*b*, 4–5*e*(3), 4–6, 5–4*b*(6), and 5–5*g*(2).)

AR 385–10
The Army Safety Program (Cited in paras 5–1*d*, 5–5*e*(3), figs B–2, C–1.)

DA Pam 385–24
The Army Radiation Safety Program (Cited in paras 2–2, 2–3*a*, 2–4*d*(1), 3–4*a*, 3–6*c*, 4–2, 5–1*d*, and 5–5*e*(3).)

DA Pam 385–40
Army Accident Investigations and Reporting (Cited in paras 5–1*d*, 5–5*e*(3).)

DODI 6055.08
Occupational Ionizing Radiation Protection Program (Cited in paras 1–1, 4–7*b*.)

JP 3–11
Operations in Chemical, Biological, Radiological, and Nuclear (CBRN) Environments (Cited in table 2–2.) (Available at http://www.dtic.mil/doctrine/new_pubs/jointpub.htm.)

NRC RIS 2002–06
Evaluating Occupational Dose For Individuals Exposed to NRC–Licensed Material and Medical X–Rays (Cited in para 3–1*b*(5)(*a*).) (Available at http://www.nrc.gov.)

NUREG–1556 Series
Consolidated Guidance About Materials Licenses (Cited in para 5–3*b*.) (Available at http://www.nrc.gov.)

TG–211
Radiobioassay Collection Labeling and Shipping Requirements (Cited in paras 3–6*g*, 3–6*l*(2), and 5–2*g*(1)(*d*).) (Available at http://phc.amedd.army.mil/.)

10 CFR 19
Notices, Instructions, and Reports to Workers: Inspection and Investigations (Cited in paras 1–1, 4–7*a*(3)(*e*), 4–8*a*, 4–8*b*, and fig B-1.)

10 CFR 20
Standards for Protection Against Radiation (Cited in paras 1–1, 2–1, 2–3, 2–4*a*, 2–5*a*, 2–7, 3–1*b*(7), 3–1*c*(2), 3–6*a*(1), 3–6*g*, 3–6*k*, 4–2, 4–3*b*(2), 4–8*a*, 5–1*b*, 5–5*e*(3), table 2–1, table 2–2, table 5–3, figs B–2, C–1, and glossary.)

10 CFR 34
Licenses for Industrial Radiography and Radiation Safety Requirements for Industrial Radiographic Operations (Cited in paras 3–1*b*(6), 5–5*e*(3).)

10 CFR 35
Medical Use of Byproduct Material (Cited in paras 3–6*g*, 5–5*e*(3).)

10 CFR 36
Licenses and Radiation Safety Requirements for Irradiators (Cited in paras 3–1*b*(7), 3–1*c*(7), and 5–5*e*(3).)

10 CFR 39
Licenses and Radiation Safety Requirements for Well Logging (Cited in paras 3–1*b*(8), 5–5*e*(3).)

29 CFR 1910
Occupational Safety and Health Standards (Cited in paras 1–1, 4–7*a*(3)(*e*), 4–8, 5–1*c*, 5–5*e*(3), table 5–3, figs B–1, B–2, and C–1.)

40 CFR 61.102
Standard (Cited in paras 2–7*c*, 4–8*a*(5), and 5–1*c*.)

73 FR 45029
Planning Guidance for Protection and Recovery Following Radiological Dispersal Device (RDD) and Improvised Nuclear Device (IND) Incidents, August 1, 2008, Federal Emergency Management Agency (Cited in table 2–3.) (Available at http://www.gpo.gov/fdsys/browse/collection.action?collectionCode=FR.)

Section II
Related Publications

A related publication is merely a source of additional information. The user does not have to read a related publication to understand this publication. Army publications are available on the APD Web site, http://www.apd.army.mil. DOD publications are available at http://www.dtic.mil/whs/directives. NRC publications are available at http://www.nrc.gov. ICRP publications are available for purchase at http://www.icrp.org. NCRP Reports are available for purchase at http://www.ncrppublications.org. United Nations Scientific Committee on the Effects of Atomic Radiation Reports (UNSCEAR) are available at http://www.unscear.org. U.S. Codes are available at: http://www.gpo.gov/fdsys/.

AR 25–1
Army Knowledge Management and Information Technology

AR 40–3
Medical, Dental, and Veterinary Care

AR 40–5
Preventive Medicine

AR 40–66
Medical Record Administration and Healthcare Documentation

AR 40–501
Standards of Medical Fitness

AR 50–7
Army Reactor Program

TB MED 525
Control of Hazards to Health from Ionizing Radiation Used by the Army Medical Department

AAPM Report No. 18
A Primer on Low-Level Ionizing Radiation and Its Biological Effects (Available at http://www.aapm.org.)

ANSI N13.30
Performance Criteria for Radiobioassay (Available at http://hps.org/hpssc/.)

ANSI N13.39
Design of Internal Dosimetry Programs (Available at http://hps.org/hpssc/.)

ANSI N43.3
For General Radiation Safety - Installations Using Non-Medical X-Ray and Sealed Gamma-Ray Sources, Energies Up to 10 MeV (Available at http://hps.org/hpssc/.)

ANSI N43.5
Radiological Safety Standard for the Design of Radiographic and Radioscopic Non-Medical X-ray Equipment Below 1 MeV (Available at http://hps.org/hpssc/.)

BEIR III
The Effects on Populations of Exposure to Low Levels of Ionizing Radiation: 1980, Committee on the Biological Effects of Ionizing Radiations (BEIR III) (Available for purchase at http://iopscience.iop.org.)

BEIR IV
Health Risks of Radon and Other Internally Deposited Alpha-Emitters: 1988, Committee on the Biological Effects of Ionizing Radiations (BEIR IV), Washington, D.C.: National Academy Press (Available at http://www.nap.edu/.)

BEIR VII Phase 2
Health Risks from Exposure to Low Levels of Ionizing Radiation: 2006, Committee on the Biological Risks From Ionizing Radiations (BEIR VII), Washington, D.C.: The National Academies Press (Available at http://www.nap.edu/.)

EPA 400–R–92–001
Manual of Protective Action Guides and Protective Actions for Nuclear Incidents, Revised 1991 (Available at http://www.epa.gov/radiation/docs/er/400-r-92-001.pdf.)

ICRP Publication 12
General Principles of Monitoring for Radiation Protection of Workers

ICRP Publication 23
Report on the Task Group on Reference Man

ICRP Publication 26
Recommendations of the International Commission on Radiological Protection

ICRP Publication 30 (Parts 1 through 4)
Limits for Intakes of Radionuclides by Workers

ICRP Publication 42
A Compilation of the Major Concepts and Quantities in Use by the International Commission on Radiological Protection

ICRP Publication 48
The Metabolism of Plutonium and Related Elements

ICRP Publication 51
Data for Use in Protection against External Radiation

ICRP Publication 60
1990 Recommendations of the International Commission on Radiological Protection

ICRP Publication 68
Dose Coefficients for Intakes of Radionuclides by Workers

ICRP Publication 103
The 2007 Recommendations of the International Commission on Radiological Protection

NCRP Report No. 38
Protection Against Neutron Radiation

NCRP Report No. 39
Basic Radiation Protection Criteria

NCRP Report No. 57
Instrumentation and Monitoring Methods for Radiation Protection

NCRP Report No. 58
A Handbook of Radioactivity Measurements Procedures

NCRP Report No. 96
Comparative Carcinogenicity of Ionizing Radiation and Chemicals

NCRP Report No. 106
Limit for Exposure to "Hot Particles" on the Skin

NCRP Report No. 114
Maintaining Radiation Protection Records

NCRP Report No. 116
Limitation of Exposure to Ionizing Radiation

NCRP Report No. 122
Use of Personal Monitors to Estimate Effective Dose Equivalent and Effective Dose to Workers For External Exposure to Low-LET Radiation (Available for purchase at http://www.ncrppublications.org/Reports/122.)

NRC Regulatory Guide 8.7, Revision 2
Instructions for Recording and Reporting Occupational Radiation Dose Data

NRC Regulatory Guide 8.9, Revision 1
Acceptable Concepts, Models, Equations, and Assumptions for a Bioassay Program

NRC Regulatory Guide 8.10, Revision 1–R
Operating Philosophy for Maintaining Occupational Radiation Exposures As Low As Is Reasonably Achievable

NRC Regulatory Guide 8.11
Applications of Bioassay for Uranium

NRC Regulatory Guide 8.13, Revision 3
Instruction Concerning Prenatal Radiation Exposure

NRC Regulatory Guide 8.15, Revision 1
Acceptable Programs for Respiratory Protection

NRC Regulatory Guide 8.18, Revision 1
Information Relevant to Ensuring that Radiation Exposures at Medical Institutions Will Be As Low As Is Reasonably Achievable

NRC Regulatory Guide 8.20, Revision 1
Applications of Bioassay for I–125 and I–131

NRC Regulatory Guide 8.22, Revision 1
Bioassay at Uranium Mills

NRC Regulatory Guide 8.25, Revision 1
Air Sampling in the Workplace

NRC Regulatory Guide 8.29, Revision 1
Instruction Concerning Risks from Occupational Radiation Exposure

NRC Regulatory Guide 8.31, Revision 1
Information Relevant to Ensuring that Occupational Radiation Exposures at Uranium Recovery Facilities Will Be As Low As Is Reasonably Achievable

NRC Regulatory Guide 8.32
Criteria for Establishing a Tritium Bioassay Program

NRC Regulatory Guide 8.34
Monitoring Criteria and Methods to Calculate Occupational Radiation Doses

NRC Regulatory Guide 8.35
Planned Special Exposure

NRC Regulatory Guide 8.36
Radiation Dose to the Embryo/Fetus

NRC Regulatory Guide 8.37
ALARA Levels for Effluents from Materials Facilities

NRC Regulatory Guide 10.8
Guide for the Preparation of Applications for Medical Use Programs

STANAG 2083
Commanders' Guide on the Effects from Nuclear Radiation Exposure During War (Available at http://www.ihs.com/products/industry-standards/organizations/NATO/index.aspx.)

STANAG 2474
Determination and Recording of Ionizing Radiation Exposure for Medical Purposes (Available at http://www.ihs.com/products/industry-standards/organizations/NATO/index.aspx.)

UNSCEAR 2006 Report Volume 1
Effects of Ionizing Radiation, United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) Sources, 2006

UNSCEAR 2008 Report Volume I
Sources and Effects of Ionizing Radiation, United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) Sources, 2008

UNSCEAR 2010 Report
Scientific Report: Summary of Low-Dose Radiation Effects on Health (UNSCEAR) Sources, 2010

USADC Handbook Version 4.2
Customer Handbook, 2010 (Available at https://cecomsafety.apg.army.mil/safety/rso/tbtmtrs/hbk_dosimetry.pdf.)

10 CFR 30
Rules of General Applicability to Domestic Licensing of Byproduct Material

10 CFR 31
General Domestic Licenses for Byproduct Material

10 CFR 32
Specific Domestic Licenses to Manufacture or Transfer Certain Items Containing Byproduct Material

10 CFR 33
Specific Domestic Licenses of Broad Scope for Byproduct Material

10 CFR 40
Domestic Licensing of Source Material

29 CFR 570
Child Labor Regulations, Orders, and Statements of Interpretation

52 FR 2882
Radiation Protection Guidance to Federal Agencies for Occupation Exposure, 27 January 1987 (Available at http://www.epa.gov/radiation/docs/federal/52-fr-2822.pdf.)

5 USC 552a
Records maintained on individuals

5 USC 301
Departmental regulations

42 USC
The Public Health and Welfare

42 USC 5801
Congressional Declaration of Policy and Purpose

44 USC
Public Printing and Documents

Section III
Prescribed Forms
Unless otherwise indicated, DA forms are available on the APD Web site (http://www.apd.army.mil).

DA Form 7689
Bioassay Information Summary Sheet (BISS) (Prescribed in paras 3–6*h*, 3–6*k*(1), 3–6*l*, 4–3, and app C.)

Section IV
Referenced Forms
Unless otherwise indicated, DA forms are available on the APD Web site (http://www.apd.army.mil); DD forms are available on the Office of the Secretary of Defense (OSD) Web site (http://www.dtic.mil/whs/directives/infomgt/forms/formsprogram.htm).

DA Form 285–AB
(U.S. Army Abbreviated Ground Accident Report (AGAR))

DA Form 2028
Recommended Changes to Publications and Blank Forms

DD Form 1952
Dosimetry Application and Record of Previous Radiation Exposure

NRC Form 4
Cumulative Occupational Dose History (Available at http://www.nrc.gov.)

NRC Form 5
Occupational Dose Record for a Monitoring Period (Available at http://www.nrc.gov.)

OSHA Form 300
Log of Work-Related Injuries and Illnesses (Available at http://www.osha.gov.)

Appendix B
DD Form 1952 (Dosimetry Application and Record of Previous Radiation Exposure)

B–1. Individuals required to complete a DD Form 1952
Personnel in the dosimetry program, occupationally exposed individuals, visitors, and transient personnel who work in or frequent a restricted area, regardless of whether or not they are issued a dosimeter, will complete a DD Form 1952. Figure B–1 provides an example of a DD Form 1952.

B–2. Completion instructions for DD Form 1952
a. All individuals referred to in paragraph B–1 will——

(1) Complete blocks 1 through 10.

(2) Within the "Occupational Exposure History" section, list name, address, and dates of occupational exposure at each location, if known.

(3) Initial the statement shown in figure B–1 block 16.

(4) Initial the applicable statement shown in figure B–1 block 17.

(5) Sign and date the statement shown, to include the reading and understanding of the Privacy Act Statement on the back of DD Form 1952, in figure B–1 block 18.

(6) Complete a new DD Form 1952 for each requirement for personnel dosimetry.

b. The RSO will——

(1) Ensure that blocks 11 through 19 are completed.

(2) Determine the type of personnel dosimetry required based on the duties listed in blocks 11 and 13.

(3) Request, in writing, the previous occupational dose histories for occupationally exposed individuals who meet the conditions requiring individual dosimetry as specified in paragraph 3–1.

(a) To request from USADC an individual's personnel dose history the request will include—

1. Full name.

2. Maiden name, if applicable.

3. Full Social security number.

4. Military Service number, if applicable.

5. Date of birth.

6. If applicable, the Army command or organization to which the dosimetry program was assigned and in which the dosimeter was worn by individual.

7. Locations of occupational exposure, if known.

(b) For other Services, Federal, State, or civilian employers, provide information as per that organization's guidance to obtain individual dose history information. Individual dose history should be provided to the USADC for each civilian employer specified on the DD Form 1952. If, after 6 months from the date of the written request for individual dose history, no reply is received, the RSO will assume, for the purposes of administrative controls for the current year, that the allowable dose limit for the individual is reduced by 1.25 rem (12.5 mSv) for each quarter for which records were unavailable and the individual was engaged in activities that could have resulted in occupational radiation exposure. An individual subject to these administrative controls will not be available for PSEs.

(4) Annotate the DD Form 1952 (in the "Health Physics Use Only" area) with the date that the individual's previous occupational dose history(ies) was requested from each previous civilian employer.

(5) Check block 14 if a baseline internal dose to the body was received, analyzed, and reported prior to beginning the dosimetry program. The baseline will determine if the person has any radionuclides in his or her body from a previous exposure to internal radioactive materials.

(6) Enter in block 19 the date of the last time the person on the dosimetry program wore a dosimeter.

(7) Instruct the individual on the potential hazards of radiation exposure.

(8) Review the information in the remarks section, include the date, initial, and sign the appropriate statement (see fig B–1). The form can be digitally initialed and signed using a common access card. Once the form is fully initialed and signed, the data in the personal information section will be locked to ensure protection of the information.

c. For additional guidance on DD Form 1952, see the USADC Customer Handbook at Web site https://cecomsafety.apg.army.mil/safety/rso/tbtmtrs/hbk_dosimetry.pdf.

B–3. Additional guidance

See paragraph 4–2 for additional information concerning this form.

DOSIMETRY APPLICATION AND RECORD OF PREVIOUS RADIATION EXPOSURE

PERSONAL INFORMATION *(Print legibly or type all information requested.) (See Privacy Act Statement on reverse.)*

1. FULL NAME *(Last, First, Middle)*	2. DATE OF BIRTH *(DDMMYYYY)*	3. SOCIAL SECURITY NO.
Doe, Jane	12021977	123456789

4. DUTY SECTION *(Dept., Unit, etc., or Company, if contractor)*	5. JOB TITLE	6. DUTY PHONE	7. EMAIL ADDRESS
Radiation Safety Office, Ft. Belvoir, VA	Radiation Safety Officer	7031234567	jane.doe@mail.mil

8. HAVE YOU WORN A DOSIMETER ISSUED BY THIS COMMAND IN THE PAST?	9. DUTY STATUS	10. MAILING ADDRESS *(If temporary) (Street, City, State, ZIP Code)*
[ ] YES [X] NO	[X] PERMANENT [ ] TEMPORARY *(6 weeks or less)*	

OCCUPATIONAL EXPOSURE HISTORY

NOTE: This section only applies to the individual who has worked with radiation producing devices or radioisotopes in a permanent status. List only those employers for whom you worked with radiation. If you have not been issued a dosimeter previously, enter "None" in the first block.

11. NAME OF EMPLOYER	12. ADDRESS *(Street, City, State, ZIP Code)*	13. FROM MO	13. FROM YR	14. TO MO	14. TO YR	*Health Physics Use only*
Vermont Yankee Nuclear Power Plant	1234 Old Ferry Rd Brattleboro, VT 05320	Oct	2005	Dec	2011	
(Attach a list if needed)				15. TOTAL EXPOSURE DATA		

REMARKS

16. Individual has received instruction on potential hazards associated with use of or exposure to radiation. The potential risk associated with exposure is such that bioassay [ ] is [X] is not required. *(X one).*

a. DATE: 15 Mar 12 b. RSO'S INITIALS: DIGITAL SIGNATURE c. INDIVIDUAL'S INITIALS: DIGITAL SIGNATURE

17. *(Initial a. or b. below):*

a. I state that I have had no prior occupational dose during the calendar year. INDIVIDUAL'S INITIALS: DIGITAL SIGNATURE

b. I state that I have received an estimated total dose of _____ during the calendar year. INDIVIDUAL'S INITIALS: _____

STATEMENT

18. I hereby certify that the exposure history listed above is correct and complete to the best of my knowledge and belief. Receipt of the dosimeter states that I will uphold all NRC and Army requirements for proper use and storage. In the event of theft or loss, I will immediately notify the RSO or his/her delegate. Under the provisions of 10 CFR 19.13, 29 CFR 1910.1096 and the Privacy Act of 1974, I hereby authorize the release of, and request that all of my radiation exposure records be furnished to appropriate authorities in accordance with the "Routine Uses" portion of the Privacy Act Statement. As a radiation worker, I have been provided instruction in radiation protection by 10 CFR 19.12 and 29 CFR 1910.1096. I have been informed of the biological effects and the risks from ionizing radiation on the embryo-fetus. I understand pregnant female workers may formally declare their pregnancy to be restricted to a lower dose limit. I understand female workers should contact the RSO for additional training when they disclose their pregnancy. I have read and understand the Privacy Act Statement on the reverse of this form.

a. SIGNATURE: DIGITAL SIGNATURE 12345678 b. DATE SIGNED: _____

EXPOSURE INFORMATION *(THIS SECTION IS FOR HEALTH PHYSICS USE ONLY)*

19. CLASSIFICATION OF EXPOSURE	20. DOSIMETER REQUIRED	21. BIOASSAY REQUIRED *(If "Yes", complete blocks 22 - 24)*
[ ] INTERNAL [X] EXTERNAL	[X] WHOLE-BODY [ ] WRIST [ ] FINGER [ ] HEAD-AND-NECK [ ] NEUTRON	[ ] YES [X] NO

22. BASELINE	23. TYPE OF BIOASSAY (SPECIMEN MATRIX/RADIONUCLIDE)	24. FREQUENCY
[ ] YES [ ] NO		[ ] MONTHLY [ ] QUARTERLY [ ] ANNUALLY [ ] OTHER _____

25. DOSIMETER(S) ISSUED	26. LAST DOSIMETER(S)	27. GIVE DATES FOR ITEMS 24 AND 25 *(DDMMYYYY)*

DD FORM 1952, SEP 2011 PREVIOUS EDITION IS OBSOLETE. Adobe Professional 8.0

Figure B–1. Sample DD Form 1952 (Dosimetry Application and Record of Previous Radiation Exposure) Page 1

PRIVACY ACT STATEMENT
DATA REQUIRED BY THE PRIVACY ACT OF 1974
(5 USC 552a)

PRESCRIBING DIRECTIVE: AR 385-10.

AUTHORITY: 5 USC 301 - Departmental Regulation: Purposes; 42 USC 2073, 2093, 2095, 2111, 2133, 2134, 2201(b), and 2201(o). The authority for soliciting the social security number is 10 CFR 20; 44 USC 3101 - Record Management by Agency Heads, General Duties.

PRINCIPAL PURPOSE(S): To establish qualification of personnel monitoring and document previous exposure history. The information is used in the evaluation of risk of exposure to ionizing radiation or radioactive materials. The data permits meaningful comparison of both current (short-term) and long-term exposure to ionizing radiation or radioactive material. Data on your exposure to ionizing radiation or radioactive material is available to you upon request.

ROUTINE USES: The information may be used to provide data to other Federal agencies, academic institutions, and non-governmental agencies, such as the National Council on Radiation Protection and Measurement and the National Research Council, involved in monitoring/evaluating exposures of individuals to ionizing radiation or radioactive materials who are employed as radiation workers on a permanent or temporary basis and exposure received by monitored visitors. The information may also be disclosed to appropriate authorities in the event the information indicates a violation or potential violation of law and in the course of an administrative or judicial proceeding.

MANDATORY OR VOLUNTARY DISCLOSURE AND EFFECT ON INDIVIDUAL NOT PROVIDING INFORMATION: It is voluntary that you furnish the requested information, including social security number; however, the installation or activity must maintain a completed Automated Dosimetry Record (ADR) on each individual occupationally exposed to ionizing radiation or radioactive material as required by 10 CFR 20, 29 CFR 1910.96, and DA PAM 385-25. If information is not furnished, individual may not become a radiation worker. The social security number is used to assure that the Army/Agency has accurate identifier not subject to the coincidence of similar names or birthdates among the large number of persons on whom exposure data is maintained.

DD FORM 1952 (BACK), SEP 2011

Figure B–2. Sample DD Form 1952 (Dosimetry Application and Record of Previous Radiation Exposure) Page 2

Appendix C
DA Form 7689 (Bioassay Information Summary Sheet (BISS))

C–1. Completion Instructions for DA Form 7689

a. The RSO or bioassay specimen collector will complete Part A. For additional guidance in completing Part A contact the analyzing laboratory.

b. The RSO will complete Part B after the completion of the dosimetry assessment and forward to USADC along with the bioassay specimen data.

C–2. Additional guidance

See paragraphs 3–6 and 4–3 for additional information concerning this form.

C–3. Requirements for completion of DA Form 7689

DA Form 7689 will be completed by the RSO or specimen collector whenever a bioassay specimen is collected. See figure C–1 for an example of a DA Form 7689.

BIOASSAY INFORMATION SUMMARY SHEET (BISS)

For use of this form, see DA Pamphlet 385-25; the proponent agency is DAS.

PRIVACY ACT STATEMENT

DATA REQUIRED BY THE PRIVACY ACT OF 1974

AUTHORITY: 5 USC 301-Departmental Regulation: Purposes; 42 USC 2073, 2093, 2095, 2111, 2133, 2134, 2201(b), and 2201(o). The authority for soliciting the social security number is 10 CFR 20; 44 USC 3101-Record Management by Agency Heads, General Duties, and AR 385-10.

PRINCIPAL PURPOSE(S): To establish qualification of the internal dose from bioassay specimens. The internal dose will be added to deep dose equivalent to determine the total effective dose equivalent the individual has received annually. The total effective dose equivalent will be documented in the individual's exposure history. The information is used in the evaluation of risk of exposure to ionizing radiation or radioactive materials. The data permits meaningful comparison of both current (short-term) and long-term exposure to ionizing radiation or radioactive material. Data on your exposure to ionizing radiation or radioactive materials is available to you upon request.

ROUTINE USES: The information may be used to provide data to other Federal agencies, academic institutions, and non-governmental agencies, such as the National Council on Radiation Protection and Measurement and the National Research Council, involved in monitoring/evaluating exposures of individuals to ionizing radiation or radioactive materials who are employed as radiation workers on a permanent or temporary basis and exposure received by monitored visitors. The information may also be disclosed to appropriate authorities in the event the information indicates a violation or potential violation of law and in the course of an administrative or judicial proceeding.

MANDATORY OR VOLUNTARY DISCLOSURE AND EFFECT ON INDIVIDUAL NOT PROVIDING INFORMATION: It is voluntary that you furnish the requested information, including social security number; however, the installation or activity must maintain a completed Automated Dosimetry Record (ADR) on each individual occupationally exposed to ionizing radiation or radioactive material as required by 10 CFR 20, 29 CFR 1910.1096, and DA PAM 385-25. If information is not furnished, the individual may not become a radiation worker. The social security number is used to assure that the Army has an accurate identifier not subject to the coincidence of similar names or birthdates among the large number or persons on whom exposure data is maintained.

Bioassay Information Summary Sheet Completion Guidance:

Purpose: The Bioassay Information Summary Sheet must be completed when bioassay specimens are collected and when bioassay results are submitted to the USADC.

Completion Procedures:

Part A: The information will be used by the laboratory analyzing the data. The RSO or person responsible for collecting the specimen will fill out Part A. Check with the RSO or analyzing laboratory if there are question on how to properly fill out.

Part B: Once the dosimetry assessment is complete the RSO will fill in Part B. Generally, 10 CFR 20 requires a calculation only if an intake is greater than 10 percent of the ALI or exposure to more than 10 percent of the DAC. The uncertainty of the assessment is required and must be included as part of the results. The RSO will submit the Bioassay Information Summary Sheet along with the data of the bioassay specimen to the USADC. USADC will include the results into the individual's dose records as the committed effective dose equivalent (CEDE) which will be summed with the deep dose equivalent (DDE) for the total effective dose equivalent (TEDE).

PART A: Complete this section and submit with the bioassay specimen.

1. NAME *(Last, First, Middle)*	2. SOCIAL SECURITY NUMBER	3. DATE OF BIRTH *(YYYYMMDD)*
Doe, John Jay	123-45-6789	19931016

4. DOSIMETRY ACCOUNT CODE	5. NRC LICENSE OR ARA NUMBER
JAX	01-015475-05

6. RSO NAME	7. EMAIL	8. TELEPHONE
Jane Doe	jane.doe@us.army.mil	7031231234

9. REASON FOR BIOASSAY SPECIMEN COLLECTION	10. NUCLIDE
Broken M1a2 gunner's quadrant	H-3

11. EXPOSURE DURATION	12. DATE/TIME OF EXPOSURE *(YYYYMMDD HH:MM)*	13. EXPOSURE PATHWAY
☒ ACUTE ☐ CHRONIC	20120314 16:11	☒ INHALATION ☐ INGESTION ☐ INJECTION ☐ WOUND ☐ OTHER *(describe)*

14. NUCLIDE CHEMICAL FORM	15. SPECIMEN COLLECTION DATE/TIME *(YYYYMMDD HH:MM)*
(IF KNOWN) CLASS OR TYPE ☒ D ☐ W ☐ Y ☐ F ☐ M ☐ S	START 20120315 09:00 END 20120315 09:01

PART B: Complete this section after the dosimetry assessment is complete, then send to the U.S. Army Dosimetry Center.

16. DOSIMETRY MODELS USED	17. ESTIMATED INTAKE (microcurie)
☐ ICRP-26/30 ☐ ICRP-60/68	

18. **ICRP-26/30 DOSE EQUIVALENTS OR ICRP-60/68 EQUIVALENT DOSES**

ICRP-26/30 and ICRP-60/68			ICRP-60/68 ONLY		
ORGAN/TISSUE	**CODE**	**rem**	**ORGAN/TISSUE**	**CODE**	**rem**
GONADS	SZ		COLON	MZ	
BREAST	TZ		STOMACH	NZ	
LUNG	UZ		BLADDER	OZ	
RED BONE MARROW	VZ		LIVER	PZ	
BONE SURFACE	WZ		ESOPHAGUS	QZ	
THYROID	XZ		SKIN	RZ	
REMAINDER	YZ				
CEDE OR COMMITTED EFFECTIVE DOSE (ZZ)		rem			

19. APPROVED BY	DATE
DIGITAL SIGNATURE 123456789	20120315

DA Form 7689, SEP 2012 APD PE v1.00ES

Figure C–1. Sample DA Form 7689 (Bioassay Information Summary Sheet (BISS))

Appendix D
Recommended Investigator Actions to be Taken in the Event of a Reported Overexposure

D–1. Personnel overexposure actions

a. Use the following guidance to ensure that personnel overexposure actions are properly investigated (the RSO will consider this guidance whenever doses are higher than expected, at, or near overexposure levels).

(1) Ensure the RSO and the NRC licensee are provided with the initial notification of the TLD doses listed in the ADR and, if applicable, the bioassay results. Most overexposure investigations will not involve bioassay results. For further guidance, contact the local RSO.

(2) Ensure all affected personnel and the local commander are notified of the overexposure results.

(3) Ensure the RSO is aware of the investigation requirements provided in chapter 5.

(4) Ensure the RSO investigates the cause of the overexposure; any discrepancies in guidance, rules, protocol, measurements, and dosimetry results; and NRC noncompliance issues.

(5) Ensure the RSO documents the findings in the investigation report, which will be provided to the appropriate Army NRC licensee.

(6) The investigation report will include:

(a) The cause of the overexposure.

(b) Immediate corrective actions taken.

(c) Actions that will be taken to prevent recurrence and maintain the dosimetry program ALARA.

(d) The date when NRC compliance will be achieved, if applicable.

(e) Personnel data for each dosimetry wearer.

(f) A review of the dosimetry dose results and, if applicable, the bioassay results.

(g) Location of a dosimetry storage area.

(h) A review of the standard operating procedure (SOP) on the dosimetry program with recommendations included.

(i) Verification of data associated with the radioactive source/ionizing radiation-producing device.

(j) Dosimetry wear/usage times.

(k) Statements from each dosimetry wearer.

(l) A review of the radiation detection, indication, and computation usage procedures employed during radiological surveys.

(m) A determination as to whether the dose is actual, or if it is likely the dose to the dosimeter was not delivered appropriately to the individual.

(n) The methodology used to determine the administrative dose if used.

(7) Ensure all personnel dosimetry records are annotated properly.

(8) Ensure individuals are notified of the final dose assessment.

(9) Ensure the SOP is updated to include procedures that implement the corrective actions.

(10) Ensure personnel are re-trained by the RSO on the radiation safety program and, if changes are made to the SOP, they study the revised SOP to prevent a recurrence of the overexposure.

(11) Ensure the events and corrective actions are discussed during the next annual training event.

(12) Keep the NRC licensee involved in the process of implementing and completing the corrective actions by providing to him or her all pertinent information.

(13) Track all corrective actions to completion.

(14) Notify the local commander, RSO, command RSSO, and NRC licensee when each of the following is completed: the investigation report, all corrective actions and, if applicable, when full NRC compliance is achieved.

b. For information on ALARA investigational levels, reportable dose criteria, investigations, and potential overexposure actions see chapter 5.

D–2. General

Table 5–3 provides notification, reporting requirements, and suspense guidance for investigational dose criteria.

Glossary

Section I
Abbreviations

ADR
Automated Dosimetry Report

ALARA
as low as reasonably achievable

ANSI
American National Standards Institute

AAPM
American Association of Physicists in Medicine

AR
Army regulation

ARA
Army radiation authorization

BEIR
Biological Effects of Ionizing Radiation

BISS
Bioassay Information Summary Sheet

CBRN
chemical, biological, radiological, and nuclear

CDE
committed dose equivalent

CFR
Code of Federal Regulations

cm
centimeter (length)

cm(2)
square centimeter (area)

DA
Department of the Army

DA Pam
Department of the Army pamphlet

DASAF
Director of Army Safety

DODI
Department of Defense instruction

DSN
Defense Switched Network

EPA
U.S. Environmental Protection Agency

FAX
facsimile

IND
improvised nuclear device

JP
Joint publication

mg
milligram

mm
millimeters

NATO
North Atlantic Treaty Organization

NCRP
National Council on Radiation Protection and Measurements

No.
number

NRC
U.S. Nuclear Regulatory Commission

NVLAP
National Voluntary Laboratory Accreditation Program

OSHA
Occupational Safety and Health Administration

RDD
radiological dispersal devices

rem
roentgen equivalent man (mammal)

RSO
radiation safety officer

RSSO
Radiation Safety Staff Officer

SOP
standard operating procedures

STANAG
Standardization Agreement

TEDE
total effective dose equivalent

TLD
thermoluminescent dosimeter

TSG
The Surgeon General

USACE
U.S. Army Corps of Engineers

UNSCEAR
United Nations Scientific Committee on the Effects of Atomic Radiation

yr
year

y
year

Section II
Terms

Absorbed dose
The average energy imparted by ionizing radiation per unit mass of a specified irradiated material at the place of interest in the material. The units of absorbed dose are the radiation absorbed dose (rad) and the gray (Gy). One rad is equal to an absorbed dose of 100 ergs/gram or 0.01 Joule/kilogram. One Gy is equal to an absorbed dose of 1 joule/kilogram which is also equivalent to 100 rad. For purposes of radiation protection, 1 rad is considered to be the dose delivered by 1 roentgen of x-ray or gamma radiation.

Activity
The rate of disintegration (transformation) or decay of radioactive material. The units of activity are curie (Ci) and the becquerel (Bq). 1 Ci = 3.7 X 10^{10} disintegrations/second; Bq = 1 disintegration/second, 1 Ci = 3.7 X 10^{10}: Bq One microcurie = 3.7 X 10^{4} disintegrations/second.

Adult
An individual 18 years of age or older.

Airborne radioactive material
Radioactive material dispersed in the air in the form of dusts, fumes, particulates, mists, vapors, or gases.

Airborne radioactivity area
A room, enclosure, or area in which airborne radioactive materials, composed wholly or partly of NRC-regulated radioactive material, exist in concentrations either:

a. In excess of the DAC specified in appendix B, 10 CFR 20.

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

Annual limit on intake
The derived limit for the amount of radioactive material taken into the body of an adult worker by inhalation or ingestion in a year (40 hours per week for 50 weeks or 2000 hours per year). ALI is the smaller value of intake of a given radionuclide in a year by the reference man (see glossary for definition) annual limits on intake that would result in a CEDE of 5 rem (0.05Sv) or an CDE of 50 rem (0.5 Sv) to any individual organ or tissue. The ALI values are based on the intake rate and standards for "reference man" as defined in ICRP Publication 23.

As low as reasonably achievable
The taking of every reasonable effort to maintain exposures to radiation as far below the prevailing dose limits as practicable. These efforts must take into account: the state of technology; economics of improvements in relation to the state of technology; economics of improvements in relation to benefits to the public health and safety; and other societal and socioeconomic considerations in relation to utilization of nuclear energy and radioactive materials in the public interest. Samples of good ALARA practices may be found in NRC Regulatory Guides 8.10, 8.31, and 10.8.

Background radiation
Radiation from cosmic sources; naturally occurring radioactive material, including radon (except as a decay product of source or special nuclear material); and global fallout as it exists in the environment from the testing of nuclear explosive devices or from past nuclear accidents such as Chernobyl that contribute to background radiation and are not under the control of the licensee. "Background radiation" does NOT include radiation from source, byproduct, or

special nuclear materials regulated by the NRC; or accelerator produced radioactive materials, radium, or machine-produced ionizing radiation regulated by the DA.

Bioassay
The determination of kinds, quantities, or concentrations, and in some cases, the locations or retention of radionuclides in the human body, whether by direct measurement (in vivo counting) or by indirect (in vitro) analysis of materials excreted or removed from the human body.

Byproduct material
Such material includes the following:

a. Any radioactive material (except special nuclear material) yielded in, or made radioactive by, exposure to the radiation incident to the process of producing or using special nuclear material. Generally, byproduct material is any radioactive material inevitably produced as a byproduct from the neutron-induced fission process within nuclear reactors.

b. The tailings or wastes produced by the extraction or concentration of uranium or thorium from ore processed primarily for its source material content including discrete surface wastes resulting from uranium solution extraction processes. Underground ore bodies depleted by these solution extraction operations do not constitute "by-product material" regulated by the NRC under 10 CFR.

c. Any discrete source of radium-226 that is produced, extracted, or converted after extraction, before, on, or after August 8, 2005, for use for a commercial, medical, or research activity.

Calendar quarter
A period of time of not less than 12 consecutive weeks nor more than 14 consecutive weeks. The first calendar quarter will begin in January of each year or begin with the dosimetry issue cycle closest to January of each year. Subsequent calendar quarters will begin within 12 or 14 weeks of that date, so that no day is included in both quarters or omitted from both quarters. The definition of a calendar quarter provided by OSHA is found at the following link: http://www.osha.gov/pls/oshaweb/owalink.query_links?src_doc_type=STANDARDS&src_unique_file=1910_1096&src_anchor_name=1910.1096(b)(1).

Class
A classification scheme for inhaled radioactive material, according to its rate of clearance from the pulmonary region of the lung. Materials are classified as D, W, or Y, which indicate a range of clearance half-times: Class D (Days) - clearance half-times of less than 10 days; Class W (Weeks) - clearance half-times of 10 to 100 days; Class Y (Years) - clearance half-times of greater than 100 days.

Collective dose
The sum of the individual whole-body doses received in a given period of time by a specified population from exposure to a specified source of radiation.

Committed effective dose equivalent (CEDE, $H_{E,50}$)
The sum of the products of the committed dose equivalents for each of the body organs or tissues that are irradiated multiplied by the weighting factors (W_T) applicable to each of those organs or tissues ($T_TW_TH_T(50) = T_TW_TH_T,50 = E(50)$).

Committed dose equivalent (CDE, $H_{T,50}$ or H_{50})
The dose to some specific organ or tissue of reference (T) that will be received from an intake of radioactive material by an individual during the 50–year period following the intake.

Committed effective dose (CED, E(50))
The sum of weighted dose equivalents in all the tissues and organs of the body ($T_Tw_TH_T$). This quantity is intended to account for both nonuniform irradiation of the body and the different radiosensitivity (with respect to the induction of fatal cancer) of the various tissues and organs of the body.

Committed equivalent dose (HT(50))
See committed effective dose (CED).

Control badge
A dosimeter that is used to monitor the environment of the personnel badges at all times other than when personnel badges are being worn. Control badges are to be stored in a low radiation background area and MUST NOT be used to

monitor the working (radiation) environment. Control dosimeters (also known as ‘zero’ or ‘transit controls’) are to be designated on the dosimeter issue listing. The control badges ARE NEVER to be worn by personnel.

Controlled area
An area for the purpose of protecting individuals from undue risks associated with exposure to ionizing radiation-producing sources and devices and radioactive materials, outside of a restricted area but inside an installation boundary, access to which can be limited by the commander for any reason.

Critical organ
That organ which will sustain the greatest absorbed dose and whose associated damage by a radionuclide entering the human body will result in greatest potential impairment to the body due to the organ’s radiosensitivity.

Declared pregnant woman
A woman occupationally exposed to ionizing radiation who has voluntarily informed, in writing, her employer and the RSO of her pregnancy and the estimated date of conception.

Deep dose equivalent (DDE, Hd or H10 mm or Hp(10mm))
Applies to external, whole-body exposure and is the dose equivalent at a tissue depth of 1 centimeter (cm)(1000 mg/ cm^2) below the outer skin surface. Also known as individual dose equivalent penetrating.

Derived air concentration
The concentration of a given radionuclide in air which, if breathed by the reference man for a working year of 2000 hours (40 hours per week for 50 weeks) under conditions of light work (inhalation rate 1.2 cubic meters of air per hour), results in an intake of one ALI. DAC values are given in appendix B, 10 CFR 20.

Derived air concentration-hour
A DAC-hour is the product of the concentration of radioactive material in air (expressed as a fraction or multiple of the DAC for each radionuclide) and the time of exposure to that radionuclide, in hours. A license may take 2000 DAC-hours to represent one ALI, equivalent to a CEDE of 5 rem (0.05 Sv).

Dose
A generic term that can refer to any of the radiation dose quantities (for example, absorbed dose, dose equivalent, or committed effective dose).

Dose equivalent (DE, H(T) or H_T)
The product of the absorbed dose in tissue (D) and the quality factor (Q) at the location of interest where H(T) = (D)(Q). The units of dose equivalent are the rem and the sievert (Sv). The dose equivalent in rem is equal to the absorbed dose in rad multiplied by the quality factor; 1 rem = 0.01 Sv. The dose equivalent in Sv is equal to the absorbed dose in Gy multiplied by the quality factor; 1 Sv = 100 rem. Its purpose is to have a single unit, regardless of the type of radiation, describing the risk of fatal cancer.

Dose of record
The official estimate of the deep-dose equivalent to the whole body, lens dose equivalent, shallow-dose equivalent to the skin, and shallow-dose equivalent to the extremities based on an assessment of a dosimeter assigned to an individual and processed by a facility holding current personnel dosimetry accreditation from the NVLAP of the National Institutes of Standards and Technology. The dose of record may differ from the dosimeter assessment if independent investigation demonstrates the individual did not receive the dose the dosimeter measured. Dose of record can also include internal doses (TEDE=CEDE + DDE).

Dosimeter
A device intended to measure radiation or evaluate any quantity of irradiation for the purpose of determining an occupationally exposed individual’s ionizing radiation dose.

Effective dose equivalent (EDE, H(E) or H_E)
The sum of the products of the dose equivalent to the organ or tissue (H_T) and the weighting factors (W_T) applicable to each of the body organs or tissues that are irradiated ($H_E = TW_TH_T$).

Embryo or fetus
The developing human organism from conception until the time of birth.

Entrance or access point
Any location through which an individual could gain access to radiation areas or to radioactive materials. This includes entry or exit portals of sufficient size to permit human entry, irrespective of their intended use.

Exposure
Ionizing radiation may be either produced from machines (for example, x-ray machines, accelerators), or spontaneously emitted by radioactive material. An individual located near such machines or materials may be "exposed" to possible ionizing radiation emissions and sustain an exposure.

External dose
The portion of the dose equivalent received from radiation sources or devices outside the body.

Extremity
The hand, elbow, arm below the elbow, foot, knee, or leg below the knee.

Eye-dose equivalent (EDE)
See lens dose equivalent (LDE).

High radiation area
An area, accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 0.1 rem/hour (1 mSv/hour) at 30 cm from the radiation source or from any surface that the radiation penetrates.

Individual
Any human being.

Individual (personnel) dosimetry
The assessment of radiation dose by the use of devices designed to be worn by an individual; the assessment of CEDE by bioassay or by determination of the time-weighted air concentrations to which an individual was exposed or the assessment of dose equivalent by the use of radiation survey data.

Individual dosimetric devices
The devices designed to be worn by a single individual for the assessment of dose equivalent (such as TLDs, pocket ionization chambers, and personal air sampling devices).

Intake
The amount of radioactive material taken into the body by inhalation, absorption through the skin, injection, ingestion, or through wounds.

Internal dose
The portion of the dose equivalent received from radioactive material taken into the body.

Investigational level
A radiation dose to the worker while occupationally exposed that justifies further investigation. Such an investigation generally includes a review of the circumstances associated with the apparently abnormal internal or external dose, assessment of the consequences, and mitigation or prevention of such a dose of similar magnitude in the future.

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

Lens dose equivalent (H_{3mm} or H_p (3 mm))
The dose equivalent to the lens of the eye from external exposure of the lens of the eye to some ionizing radiation source. It is measured at an eye lens tissue depth of 0.3 cm (300 mg/cm^2). Also known as individual dose equivalent, superficial.

Limits
The permissible upper bounds of personnel radiation doses.

Lower limit of detection
The lowest level of radioactivity that a system can detect with a given level of certainty. For further information, see NCRP Report 58, Section 7.1.3.

Member of the public
An individual, such as a visitor, in a controlled or unrestricted area who normally does not work at that particular installation or activity. An individual is not, however, a member of the public during any period in which the individual receives a dose equivalent in the course of routinely working with ionizing radiation sources or devices as part of his or her normal occupation.

Minor
An individual less than 18 years of age.

Monitoring
Also known as radiation monitoring or radiation protection monitoring. Monitoring is measurement of radiation levels, concentrations, surface area concentrations, or quantities of radioactive material. Monitoring can also mean the use of data to evaluate or document actual or potential personnel occupational exposures to ionizing radiation sources or devices.

Nonstochastic effect
Also called a deterministic effect. A health effect, the severity of which varies with dose, and for which a threshold is believed to exist. Radiation-induced cataract formation and skin erythema are examples of nonstochastic effects.

Nuclear Regulatory Commission
A United States Government agency that was established by the Atomic Energy Commission's Energy Reorganization Act in 1974 (42 USC 5801), and was first opened January 19, 1975. The NRC oversees reactor safety and security, reactor licensing and renewal, radioactive material safety, security and licensing, and spent fuel management (such as, storage, security, recycling, and disposal).

Occupational dose
a. The dose received by an individual in a restricted area or during the time of employment in which the individual's assigned duties involve exposure to ionizing radiation from NRC-licensed radioactive material and non-NRC-licensed radioactive material as well as from machine-produced ionizing radiation, whether in the possession of the owner of the radiation source (licensee) or other individual.
b. Occupational dose does NOT include dose received from background radiation, as a patient from medical or dental procedures, from voluntary participation in human research programs, or as a member of the general public.

Occupationally exposed individual
Any individual who receives an occupational dose of radiation as a result of employment in an occupation involving the use of radioactive material or equipment capable of producing ionizing radiation.

Planned special exposure
An infrequent exposure to radiation, separate from and in addition to the prevailing permissible annual dose limits.

Protective action guide
The projected dose to reference man, or other defined individual, from an unplanned release of radioactive material at which a specific protective action to reduce or avoid that dose is recommended.

Public dose
The dose received by a member of the public from exposure to ionizing radiation from radionuclide or machine sources or devices.

Quality factor
The factor used for radiation protection purposes that accounts for differences in biological effectiveness between different radiations. A quality factor (Q) when multiplied by the absorbed dose (D) yields a quantity (dose equivalent H(T)) which equates to a common scale the dose equivalent of any type of ionizing radiation to which an individual is exposed. The quality factor is equivalent to the radiation weighting factor for radiation protection purposes. These factors are specified in 10 CFR 20.

Radiation
For purposes of this pamphlet, a generic term that may variously refer to alpha particles, beta particles, gamma rays, X

rays, neutrons, high-speed protons, and other particles capable of producing ionization. This term is NOT intended to connote nonionizing radiation, such as radio frequency, microwave, visible light, infrared, or ultraviolet.

Radiation absorbed dose
The original unit developed for expressing absorbed dose, which is the amount of energy from any type of ionizing radiation (for example, alpha, beta, gamma, neutrons, and so forth) deposited in any medium (such as, water, tissue, air). A dose of one Rad is equivalent to the absorption of 100 ergs (a small but measurable amount of energy) per gram of absorbing tissue. The Rad has been replaced by the Gy in the System international system of units (1Gy= 100 Rad).

Radiation area
Any area to which access is limited as deemed necessary by the responsible authority and in which appropriate precautionary measures are taken to protect personnel from exposure to radiation or radioactive material. A radiation area includes any area accessible to individuals in which ionizing radiation dose rate levels could result in an individual receiving a dose equivalent in excess of 0.005 rem/hour (0.05 mSv/hour) at 30 cm from the radiation source or from any surface that the radiation penetrates.

Radiation safety officer
A technically competent person designated by management to evaluate safety procedures and supervise the application of radiation safety program and radiation safety regulations.

Radiation Safety Staff Officer
Directs the command's radiation safety program, establishes the radiation safety policy for his or her respective areas of responsibility, and ensures the implementation of Army radiation safety policy within his or her respective areas of responsibility, including Army commands (U.S. Army Materiel Command, Forces Command, and Training and Doctrine Command), Army services component commands, and direct reporting units. The RSSO provides radiation safety consultation to his or her respective command and leadership chains, staffs, and to subordinate commanders and staffs. The RSSO coordinates reporting of accidents and/or incidents involving radiation, to include when applicable, coordination with the licensee. The RSSO serves as his or her command's radiation safety point of contact.

Radiation sources
Material, equipment, or devices which spontaneously generate or are capable of generating ionizing radiation. They include the following:

a. Nuclear reactors.

b. Medical or dental radiographic or fluoroscopic x-ray systems.

c. Particle generators and accelerators.

d. Certain electromagnetic generators, such as klystron, magnetron, rectifier, cold-cathode, and other electron tubes operating at electrical potentials that result in the production of x-rays of such energy as to be of radiological concern.

e. X-ray diffraction, industrial radiographic, and spectrographic equipment.

f. Electron microscopes.

g. Electron-beam welding, melting, and cutting equipment.

h. Nuclear moisture and density gauges.

i. Radioactive materials.

(1) Natural or accelerator produced radioactive materials.
(2) Byproduct materials.
(3) Source materials.
(4) Special nuclear materials.
(5) Fission products.
(6) Materials containing induced or deposited radioactivity.
(7) Radioactive commodities.

Radiation work permit
Locally developed and completed by the area supervisor and countersigned by the RSO prior to the start of any work in a restricted area. It describes the potential radiation hazards and protective clothing and equipment requirements for a given work assignment. It also provides a record of radiation exposures received by individuals during a given work assignment. The radiation work permit will be initiated by the area supervisor or the RSO when required to minimize the exposure to the radiation worker(s).

Radionuclide
A radioactive species of atom characterized by its mass number (A), atomic number (Z), and nuclear energy state, provided that the mean life of that state is long enough to be observable.

Reference man
A hypothetical aggregation of human physical and physiological characteristics arrived at by international consensus. These characteristics may be used to standardize results of experiments and to relate biological insult to a common base.

Respiratory protective device
An apparatus, such as a respirator, used to reduce an individual's intake of airborne radioactive material.

Restricted area
An area to which access is limited by the commanders of DA installations and activities for the purpose of protecting individuals from undue risks associated with exposure to ionizing radiation-producing sources and devices and radioactive materials. Restricted areas do not include areas used as residential quarters; however, a separate room in a residential building may be set aside as a restricted area.

Roentgen
The special unit of exposure. One roentgen equals 2.58 x 10^{-4} coulombs per kilogram of air. It applies only to electromagnetic radiation, that is, nonparticulate radiation of photon energies between several kiloelectron Volt (keV) and 3 million electron volts (MeV) that produce ionization in air only.

Roentgen equivalent man (mammal)
The rem is a special unit of any of the quantities expressed as dose equivalent. The dose equivalent in rem is equal to the absorbed dose in Rad multiplied by the quality factor (1 rem = 0.01 Sv).

Shallow dose equivalent (SDE, Hs or $H_{0.07\ mm}$ or H_p (0.07 mm))
The dose equivalent to the active layer of the skin from external radiation exposure. It is measured at skin tissue depth of 0.007 cm (7 mg/cm^2). Also known as skin dose, shallow dose equivalent, or individual dose equivalent superficial.

Source material
Consists of:

a. Uranium or thorium, or any combination of uranium or thorium in any physical or chemical form.

b. Ores which contain by weight one-twentieth of 1 percent (0.05%.) or more of uranium, thorium, or any combination of uranium and thorium.

c. Source material does not include special nuclear material.

Special nuclear material
Plutonium, uranium 233, uranium enriched in the isotope 233, or in the isotope 235. Any other material the NRC determines to be special nuclear material as defined by 10 CFR 20. Special nuclear material does not include source material.

Stochastic effects
Health effects that occur randomly and for which the probability of the effect occurring, rather than its severity, is assumed to be a linear function of dose without threshold. Hereditary effects and cancer incidence are examples of stochastic effects.

Survey
An evaluation of the radiological conditions and potential hazards incident to the production, use, transfer, release, disposal, or presence of radioactive material or other sources of ionizing radiation. When appropriate, such an evaluation includes a physical survey of the location of radioactive material and measurements or calculations of levels of radiation, or concentrations, or quantities of radioactive material present.

System international units
Units established by the International Commission on Radiological Units and used by many countries. As such, they may be encountered in the scientific literature. Historically, so-called "traditional" units of the rem, rad, and Ci, equate to system international units in the following manner:

a. One Gy = 100 rad

b. One Sv = 100 rem

c. One Bq = 2.7x10–$^{-11}$ Ci; or equals one disintegration/second

d. One Rad = One centigray (cGy); or $1x10^{-2}$Gy
e. One rem = One centisievert (cSv); or $1x10^{-2}$ Sv
f. One Ci =$3.7x10^{10}$ Bq

Termination
The end of employment with DA, Army National Guard/Army National Guard of the United States, or U.S. Army Reserve. Also, the end of a work assignment in a restricted area.

Total effective dose equivalent
The sum of the deep dose equivalent (DDE) plus the committed effective dose equivalent (CEDE).
TEDE = DDE + CEDE.

Unrestricted area
Any area to which access is neither limited nor controlled for purposes of radiation protection by commanders of DA installations and activities that possess and use ionizing radiation sources and devices to include any area used for residential quarters.

User
An individual who has been delegated the authority for the use, operation, or storage of radiation sources and devices.

Very high radiation area
An area, accessible to individuals, in which there exists ionizing radiation at such levels that an individual could receive in excess of 500 rad/hour (5 Gy/hour) at 1 meter from a radiation source or from any surface that the radiation penetrates.

Visitor
See member of the public.

Weighting factor (w_T)
The decimal fraction specified for an organ or tissue whose magnitude is the quotient of the risk of stochastic effects resulting from irradiation of that organ or tissue (T) to the total risk of stochastic effects when the whole body is irradiated uniformly. Tissue (organ) weighting factor values for calculating the effective dose equivalent (H(E)) are specified in 10 CFR 20.1003.

Whole-body
The head, trunk (including male gonads), arms above the elbow, or legs above the knee.

Section III
Special Abbreviations and Terms

A
mass number of an atom

AGAR
abbreviated ground accident report

ALI
annual limits on intake

Bq
becquerel

C
recorded head-and-neck dosimeter exposure

CEDE
committed effective dose equivalent

Ci
curie

cGy
centigray

cSv
centisievert

D
absorbed dose in tissue

DAC
derived air concentration

DDE
deep dose equivalent

Gy
gray

ICRP
International Commission of Radiological Protection

IL
investigation level

keV
kiloelectron Volt

LET
linear energy transfer

LDE
lens dose equivalent

MeV
million electron volts

mrem
one thousandth of one rem

mSv
millisievert

NUREG
U.S. Nuclear Regulatory Commission Regulation

PSE
planned special exposure

Q
quality factor

Rad
radiation absorbed dose

SDE
shallow dose equivalent

Sv
sievert

T
dose to some specific organ or tissue of reference

USADC
U.S. Army Dosimetry Center

USAIPH
U.S. Army Institute of Public Health

W
recorded whole-body dosimeter exposure

W_T
weighting factor

Z
atomic number